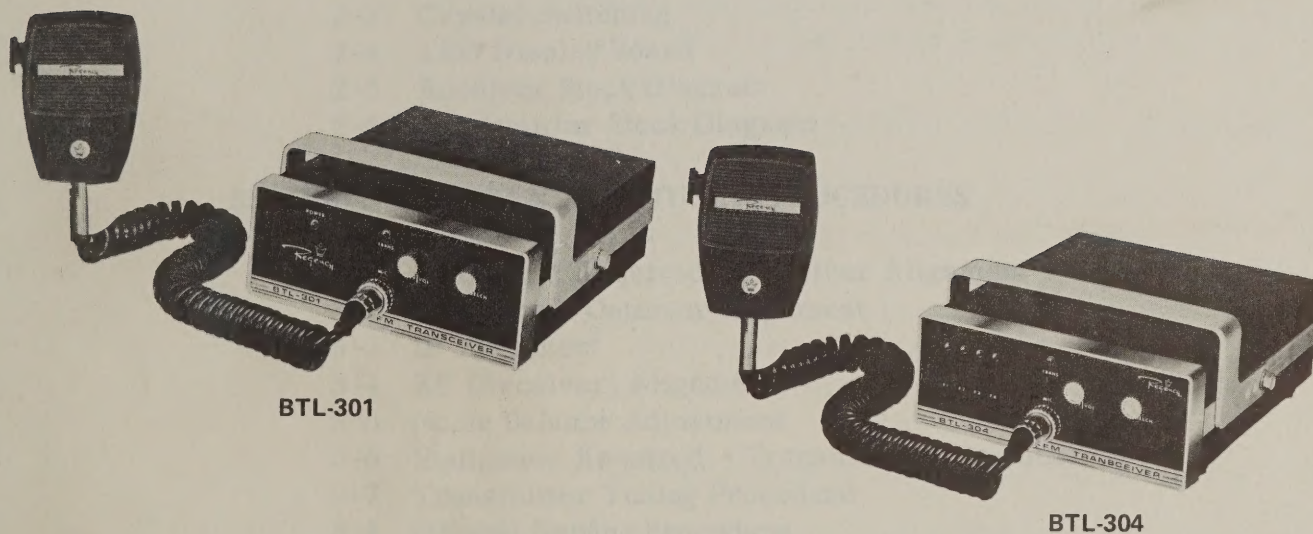




ELECTRONICS INC.

SERVICE MANUAL



BTL-301

BTL-304

MODELS BTL-301
BTL-304

VHF FM TRANSCEIVER

BTL-301 AND BTL-304 SERVICE MANUAL

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SECTION 1 GENERAL INFORMATION

1-1 DESCRIPTION

The Regency BTL-301 and BTL-304 are all-transistor, FM transceivers designed for use in the VHF (29-50 MHz) Communications Low Band. The BTL-301 and BTL-304 are, respectively, one and four channel versions of the same basic transceiver design. The transmitter and receiver sections both employ band-pass circuitry for maximum RF power output and receiver sensitivity. Receive and Transmit frequencies are both crystal controlled.

The receiver section is a double-conversion, super-hetrodyne type with a MOS FET first mixer. Silicon transistors are utilized for dependability under widely varying ambient conditions. Also, two Integrated Circuits are used, providing for compactness and circuit reliability. In addition, a ceramic filter is employed in the second I.F. for optimizing receiving performance where numerous channels are active within the same area of the country.

The transmitter section also utilizes silicon transistors throughout. Two ruggedized RF power transistors (BET or Balanced Emitter transistor type) are employed for high power output (30 watts). A large, copper heat sink ensures that there is virtually no power drop off during lengthy transmissions. In addition, an SWR bridge limiting circuit provides the necessary protection to the RF power transistors in the event the antenna or its coaxial feedline becomes open or shorted.

The transmitter employs phase modulation for the ultimate in carrier stability. Internal controls are provided for adjusting the microphone gain and for setting the amount of deviation. The deviation control is adjusted for a maximum of 5 KHz deviation, in conformance with FCC Regulations.

The attenuation of spurious emissions from the transmitter, RF power output frequency stability, performance under highly varying conditions of temperature and battery voltage, and other specifications, all exceed the limits required for Type Acceptance by the Federal Communications Commission.

NOTE: The Regency Type BTL-301 and BTL-304 Transmitters are Type Accepted under Parts 21, 89, 91 and 93 of the Federal Communications Commissions Rules and Regulations. The receiver section is Certified under Part 15, Subpart C as required by the FCC Rules and Regulations.

1-2 SPECIFICATIONS

RECEIVER

Antenna Impedance..... 50 ohms

Channels..... 1 Crystal Controlled (BTL-;
4 Crystal Controlled (BTL-3

Frequency Range..... 29-50 M

Factory Tuned In 3 Segments..... 29-35 MI
35-44 MI
44-50 MI

Sensitivity..... 0.35 μ v 20 DB Quieting Nomin

Selectivity..... 6 DB \pm 7.5 KHz; 70 DB \pm 15 KH

Spurious Rejection..... 60 DI

Intermodulation Rejection..... 60 DB

Modulation Acceptance..... \pm 7.5 KHz

Audio Output..... 3 Watts 10%, or less, Distortion
5 Watts Maximum

Squelch System..... All Noise Compensated

I.F. System..... Double Conversion 10.7 MHz — 455 KHz

Part 15 FCC Certified as follows:

<u>Frequency Range</u>	<u>Receiver Certification No.</u>
29-35 MHz	RL 14A
35-44 MHz	RL 14B
44-50 MHz	RL 14C

TRANSMITTER

Antenna Impedance..... 50 ohms

Channels..... 1 Crystal Controlled (BTL-301)
4 Crystal Controlled (BTL-304)

Frequency Range..... 29-50 MHz

Factory Tune Ranges (7)..... 29-32 MHz
32-35 MHz
35-38 MHz
38-41 MHz
41-44 MHz
44-47 MHz
47-50 MHz

Power Output..... 30 Watts (minimum) at 13.8 VDC

Power Bandwidth..... 1.0 MHz Maximum

Output Frequency Stability..... 0.002%, -30 to +60°C

Spurious & Harmonic Rejection..... 58 DB (min.)

Power Unit Protection..... VSWR Bridge Limiting
Protection Circuit

Emission..... 16F3

Mike Pre-Amp..... FET Input with Internal Level Control

Microphone..... High Impedance Plug-in Ceramic

Modulation.....Phase Modulation with
Automatic Deviation Limiting

Deviation..... Factory Adjusted to ± 5 KHz (max.)

Heat Sink Solid Copper 1/8" Thick
Type Acceptance: 21, 89, 91, 93

POWER

Power Requirements..... 13.8 Volts (nominal)

Receive (Squelched)..... 180 MA.

Receive (Max. Audio Output)..... 800 MA.

Transmit..... 5.0 Amps (max.)

Fuse Size..... 10 Amp. 3AG

SEMICONDUCTORS

Integrated Circuits..... 3

Silicon Transistors (Total)..... 25

Silicon BET Power Transistors..... 2

Dual Gate MOS FET Transistor..... 1

Field Effect Transistors.....	2
Zener Diodes.....	2
Varicap Diodes.....	2
Signal Diodes.....	5 (BTL-301) 8 (BTL-304)
Rectifier Diode.....	1
Light Emitting Diodes.....	2 (BTL-301) 5 (BTL-304)

GENERAL FEATURES

Front Panel Size.....	2 5/8" x 6 1/2"
Depth (Including Knobs).....	9 1/2"
Weight (Complete).....	6 1/2 Lbs.
Speaker.....	4" Square, 3.2Ω Impedance

1-3 EQUIPMENT SUPPLIED

- a. 1 - Transceiver unit
- b. 1 - Microphone and Connector
- c. 1 - Mobile Mounting Bracket
- d. 1 - Mobile Mounting Hardware
- e. 1 - Security Bracket
- f. 1 - DC Power Cord and Fuse
- g. 1 - Owner's Instruction Manual

1-4 EQUIPMENT NOT SUPPLIED

- a. 1 - Antenna
- b. 1 - Coaxial Cable feedline
- c. 1 - Coaxial Cable connector
- d. 1 - Power Supply (battery)
- e. 1 - Pad lock (used with Security Bracket)

1-5 INSTALLATION

The BTL-301 and BTL-304 transceivers are designed for installation in a vehicle that has a 12 VDC negative ground system. The RED lead, with the fuse holder, must be connected to the positive (+) terminal side

of the battery. The BLACK lead should be connected to the negative terminal of the battery, or to a metal chassis that is grounded to the negative terminal. In the event that the battery is remotely located, it may be necessary to install additional wires for properly connecting the radio to the battery's terminals.

The antenna used should be properly adjusted for the 50 ohm output of the transmitter. A high SWR will reduce the power out, or may even shut off the transmitter entirely.

To reduce the possibility of theft, the Security Bracket should be installed as shown in Figure 1-1. The padlock used should be of substantial construction and can be either a key or combination operated type.

An external (or remotely mounted) speaker can be used by first opening the link between terminals No. 2 and No. 3. Then, connect one lead of external speaker to terminal No. 1 (chassis ground) and the other lead to terminal No. 3. The use of a 3 to 4 ohm speaker is recommended for optimum performance.

1-6 OPERATION

Volume Control/Off-On Switch:

This control varies the audio output level for the internal speaker. It also varies the level of audio present at the external speaker connection. Clockwise rotation of this control turns the receiver on and increases the volume.

Squelch Control:

This control eliminates background noise in the absence of a signal. Full clockwise rotation removes all squelch action. Turning this control counter-clockwise until the noise disappears permits the receiver to be "quiet" until an actual signal is received. Even if the squelch control is set fully counter-clockwise, the receiver will still operate properly and will not be locked-out or prevented from receiving a signal.

BTL-304 Channel Selector Buttons:

The BTL-304 is capable of two-way communications on any one of four discrete, crystal-controlled frequencies, or channels. Selection of the desired channel is accomplished by pressing the corresponding channel selector button on the front panel of the unit. The radio will neither receive nor transmit unless one of these buttons is depressed so that a channel indicator lamp is on.

NOTE: Do NOT push more than one channel selector switch button in at a time.

Indicator Lamp:

- BTL-301: Two LED's (Light Emitting Diode) are located on the front panel of the unit. The LED labeled "POWER" functions as a pilot lamp indicating whether the unit is turned on or off. The LED labeled "TRANS" is a transmit indicator which glows red whenever the transmitter is keyed on (activated).
- BTL-304: Above each channel selector button is a LED which glows whenever its corresponding channel button is pressed. These lamps make it easy to tell at a glance which channel has been selected and to also verify that the radio is turned on. The remaining LED is a Transmit Indicator which glows whenever the transmitter is keyed on.

Microphone:

A high impedance ceramic microphone is supplied with the unit. To install the microphone on the radio set, insert the connector plug into its socket with the locating tab toward the radio. The connector is then locked into place by rotating the locking ring 1/4 turn clockwise.

To transmit a message, it is only necessary to turn the radio set on, press the push-to-talk button on the microphone and speak into the microphone. The Transmit Indicator will come on to signify that the transmitter is operating.

Best results are obtained by holding the microphone about one inch from the lips, inclined at about a 30 degree angle away from the face. Speak clearly in a normal tone of voice across the face of the microphone.

1-7 CRYSTAL SPECIFICATIONS

Minature plug-in crystals are utilized by both the receiver and transmitter sections.

The following Regency Part Number crystals are used:

Receive Crystals:	302-031
Transmit Crystals:	302-075

Crystals should be ordered by specifying the above part numbers and the exact channel frequency required.

1-8 CRYSTAL INSTALLATION

Prior to installing a crystal, the transceiver's cover will have to be removed. To remove this cover, unscrew the two large bolts located at the sides of the unit. The cover may then be slipped off by sliding it toward the rear of the unit.

Next, the speaker should be removed. Unscrew the two small metal screws (one located on each side) holding the speaker mounting brackets in place. Then carefully place the speaker assembly along side of the unit.

Insert the crystal, or crystals, in the proper socket pins as indicated on the Crystal Location Diagram, 4-9. The number by each pair of sockets matches the channel designation that appears on the front panel (BTL-304 ONLY).

For each TRANSMIT crystal, there is a variable capacitor that is to be used for "Netting" (adjusting to the exact frequency) each transmit crystal. This netting should be made with an accurate frequency counter.

NOTE: FCC Regulations require that the TRANSMIT crystal be installed and adjusted "on frequency" under the supervision of a technician holding either a First or Second Class FCC license.

After all crystals are installed, and netted, reinstall the speaker assembly. Then carefully reinstall the cover and its hardware.

SECTION 2 CIRCUIT DESCRIPTIONS

2-1 RECEIVER BOARD

The entire receiver from RF through audio output circuitry is mounted on the one receiver circuit board. The antenna is connected to an RF Bandpass Filter which acts as a preselector for incoming signals. The bandwidth of this filter is approximately 1 MHz, and consequently, the filter (L101, L102, L103) must be tuned to the portion of the band being used.

Q101 is a Dual Gate MOS FET mixer. The output of the RF Bandpass Filter is coupled to Gate 2, while the L.O. (local oscillator) output is injected into Gate 1. The output of Q101 is at the 10.7 MHz, First I.F. frequency. The gain of this stage is high enough that no RF preamplifier is needed to achieve good sensitivity.

The first L.O. (local oscillator), uses third overtone crystals. (The number marked on the crystal is the channel frequency). Oscillator injection to the mixer is accomplished by coupling the oscillator output to a tuned circuit on Gate 1 of the mixer.

The 10.7 MHz output frequency from the FET mixer is selected by T101. This output is amplified by Q103, a J-FET amplifier, and fed to an integrated circuit, IC101, which contains another amplifier for 10.7 MHz, the second mixer circuitry and the second L.O. circuitry, operating at 10.245 MHz. In some locations where a strong Image Signal has been encountered, this oscillator's frequency is moved to 11.155 MHz. (The crystal frequency is stamped on the top of the crystal).

The 455 KHz output of IC101 (terminal 5) is coupled through a tuned circuit to the input of the ceramic filter, CF-1. CF-1 is a narrow-band filter centered at 455 KHz. The excellent bandpass characteristics of CF-1 provide for very good adjacent channel rejection. The output of CF-1 is amplified by Q104 and coupled through another tuned circuit to the input of integrated circuit IC102. IC102 is a series of amplifiers providing approximately 60 DB gain at 455 KHz. Also included in IC102 is the limiting circuitry and a quadrature detector circuit. L108, connected between terminals 2 and 12 of IC102, is the adjustable quadrature coil.

The audio output from IC102 (terminal 1) is coupled to the input of the audio amplifier circuit and to the input of the noise-operated squelch circuit.

Transistor Q105 is an amplifier whose frequency response extends from approximately 5 KHz to 25 KHz. Q105 amplifies the "noise" occurring in this frequency range. The noise is coupled to the base of Q106. Q106 is used as a detector which rectifies the amplified noise and produces a DC voltage at its collector. When the DC voltage at the collector of Q106 is positive and of sufficient value to provide base bias for Q107, Q107 turns off and provides essentially a short circuit between the base of Q108 and ground. This action turns off Q108

and the audio output from the receiver is squelched (muted). When a signal (carrier) arrives, the noise input to the detector (Q106) is reduced to the point where the DC voltage at the base of Q107 is no longer sufficient to cause Q107 to conduct.

At this time, Q108 is allowed to conduct normally and the audio output of the unit is heard. With the audio preamplifier, (Q108) operating normally, audio is applied through the volume control to the base of the audio amplifier, Q109. Q109 supplies a signal to the audio driver transistors, Q110 and Q111. The output transistors, Q112 and Q113, form a quasi-complementary, transformerless stage capable of delivering 5 watts to the speaker.

2-2 TRANSMITTER BOARD

AUDIO SECTION

The audio amplifiers, Q201 and Q202, provide a high impedance input for the ceramic microphone supplied with the input and provides adjustable gain to compensate for variations in microphone characteristics. A low pass filter at the input rejects interference above the normal speech band limit of 3000 Hz. The Q202 circuitry is designed to provide a high output impedance for driving the modulation limiter circuit.

The clipper circuit (CR201 and CR202) allows signals whose amplitude is below the diodes' forward conduction threshold to pass undistorted. The peaks of large signals, however, drive the diodes into conduction where their exponential characteristic effectively limits the voltage of the signal peaks while shunting the peak currents to ground.

Q203 amplifies the output of the clipper circuit and drives the modulator circuit. Two low pass filters, one at the input of Q203 and one at the output, remove the harmonics generated by signal clipping in the Modulation Limiter circuit so that the Authorized Bandwidth is not exceeded at maximum deviation. The audio frequency response of this section meets or exceeds FCC requirements.

The deviation control (R216) in the collector circuit of Q203 sets the level of the audio signal voltage applied to the Varactor diode modulator circuit. This level is adjusted for a maximum of 5 KHz deviation with the clippers driven to full clip by a 400 Hz audio signal.

The push-to-talk (PTT) switch in the microphone applies a ground to the transmit-receive relay coil, which activates the relay. The T-R relay switches the supply voltage between the receiver and transmitter and switches the antenna between the receiver input and the transmitter output.

CRYSTAL OSCILLATOR

The Oscillator Q212 is a common collector, modified colpitts type, whose frequency is determined by one of four crystals selected by the channel selector switch. Each crystal has an associated trimmer capacitor which is used for fine frequency adjustment. When used with the specified crystal type, the oscillator meets the required frequency stability without need for crystal ovens or external compensation. The primary supply voltage to the oscillator is regulated.

DIVIDER

The Divider (IC201) is a digital frequency divider which divides the output frequency of the oscillator by four (4). The purpose of the Divider is to allow both the Oscillator and the Modulator to operate at their optimum frequencies.

MODULATOR

A varactor, phase-modulator is used.

The modulator, consisting of L206, CR205, CR204 and associated circuitry, is an anti-resonant circuit tuned to one-fourth the oscillator frequency. The square wave output of the Divider is lightly coupled to the Modulator by C241. The harmonics of this output are rejected by the selectivity of the modulator circuit so that the output of the modulator consists only of the fundamental plus modulation sidebands. By varying the voltage on the two varactor diodes, CR205 and CR204, at an audio rate, the resonant frequency and consequently the phase shift of the modulator, is varied which results in the Divider output being phase-modulated at the audio frequency. The phase modulator stage modulates with low distortion over a small phase angle. The frequency multiplier stages, which follow, increase both the frequency and the deviation to the desired value.

FREQUENCY MULTIPLIER SECTION

The Divider frequency (approximately 3 MHz), is multiplied by sixteen (16) in the multiplier section to form the carrier output frequency. The multiplier string is as follows: Q211, Doubler; Q209, Doubler; Q207, Doubler; and Q206, Doubler. A double tuned, inductively coupled circuit at the output of each multiplier stage selects the desired harmonic and provides for impedance matching between stages.

POWER OUTPUT SECTION

a. Driver and Power Amplifier

The Driver (Q205) and Power Amplifier (Q204) stages amplify the carrier signal to the required output power. Additional selectivity

against spurious emissions is provided in T202. These stages operate in the Class C mode.

b. Output Matching Network

L201, L202, C217, C218, C219 and C252 make up an output "II" matching network which transforms the output impedance of Q204 to a 50Ω resistive match at the antenna terminals. This circuit also provides selectivity which attenuates the harmonics of the carrier to below the level required by the FCC. C252 and L202 form a trap which provides additional rejection of the second harmonic. No additional low pass filter is necessary. L203 is an R.F. choke which isolates the R.F. output of Q204 from the D.C. supply buss.

c. SWR Bridge

In the event of a load mismatch at the antenna terminals, the SWR Bridge consisting of T201, R218 and CR203 will detect the mismatch and send a signal to the Driver Limiter. The Driver Limiter (Q208 and Q210) will then bias Q209 in an off condition, preventing possible damage to the power amplifier (Q204). Load mismatch is detected by comparing the phases of output voltage and current to determine if standing waves exist on the line.

2-3 CRYSTAL SWITCHING

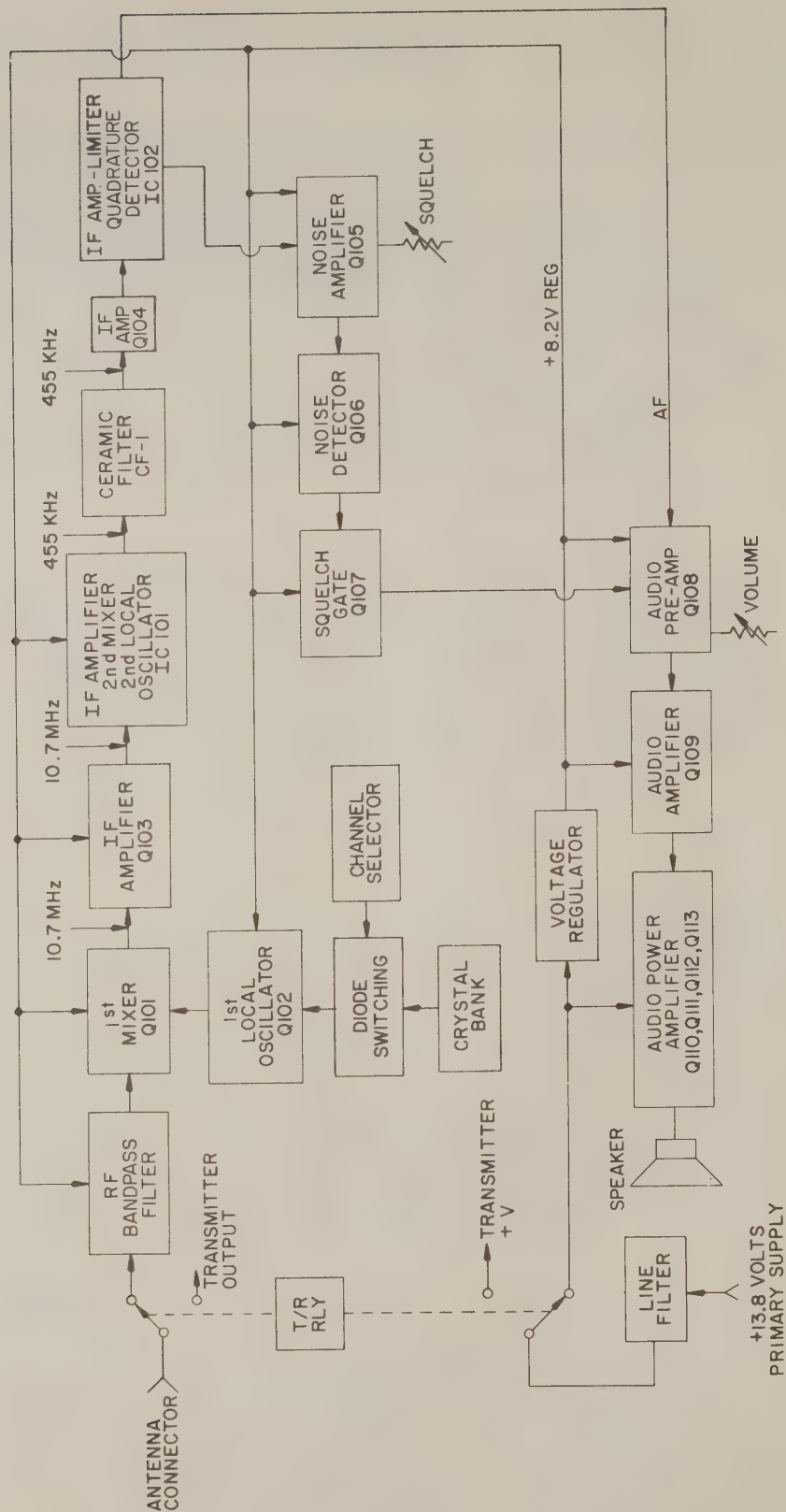
The Receiver board on the BTL-304 contains a diode switching matrix which enables the push button frequency select switch to remotely control the receive channel selected by switching a DC current only. When channel one is selected by depressing the F1 button on the front of the unit, SW1B applies a ground to R149, causing CR104 to conduct in the forward direction. Y101 is thus "switched in" through the low forward resistance of CR104. When SW1B is closed, interlocked switches SW2B through SW4B are open, causing CR105 through CR107 to be reverse biased. The high reverse resistance of these reverse biased diodes "switches out" their associated crystals. The transmitter crystals are directly switched by the "A" section of these switches (SW1A through SW4A).

2-4 LED DISPLAY BOARD

Channel Indicator (BTL-304): LD301 through LD304 function as channel indicators. When a channel selector switch button is depressed, the associated receive crystal switching contact closes, as explained in 2-2 above, grounding the cathode of the LED indicator for that channel. The LED then conducts current in the forward direction and emits a red glow. The other LED's whose switches

are open, are reverse biased and conduct no current.

Transmit & Power Indicators: The Power Indicator (BTL-301) and Transmit Indicator function similarly, except that the cathodes are grounded, and voltage to the LED's are provided, respectively, by the radio's primary power and the transmitter's supply voltage.



2-5 RECEIVER BLOCK DIAGRAM

SECTION 3 ALIGNMENT AND TUNING PROCEDURES

3-1 EQUIPMENT REQUIRED—RECEIVER ALIGNMENT

- 3-1-1 FM Signal Generator
- 3-1-2 Oscilloscope
- 3-1-3 AC VTVM
- 3-1-4 Noise Generator (to be used in 3-5 only)

NOTE: During all steps of alignment, the squelch control should be in the clockwise position (minimum squelch action).

All transceivers should be aligned to the channel nearest the center of the frequency range over which they will operate.

Diagrams 4-1 and 4-2 show the location of all coils to be adjusted.

3-2 QUADRATURE DETECTOR ALIGNMENT

- 3-2-1 Connect the FM Signal Generator to the antenna input jack. Accurately set frequency to the center of the channel being used for alignment. Modulate Signal Generator with 1000 Hz, 3 KHz deviation.
- 3-2-2 Connect the oscilloscope to Test Point A, (Junction of C139, C140, R129). See diagram 4-2.
- 3-2-3 Adjust output of Signal Generator until all noise in scope pattern just disappears.
- 3-2-4 Adjust L108 for maximum peak to peak amplitude, while maintaining symmetry of the detected signal. When L103 is properly aligned, signal should be approximately 0.2 volts RMS with test signal input as noted in 3-2-1.

3-3 IF ALIGNMENT

- 3-3-1 Disconnect RF Signal Generator from antenna input.
- 3-3-2 Connect AC voltmeter across speaker terminals.
- 3-3-3 Adjust volume control for 0.5 volt noise reading on AC voltmeter.
- 3-3-4 Peak T102 (bottom core and top core, in that order) for maximum noise (maximum meter reading on AC voltmeter). If circuit is not badly misaligned, the correct point should be within 2 turns of the cores' present position.

NOTE: Coil will have two peaks; adjust core to peak away from the center of form.

- 3-3-5 Adjust volume control for 1.0 volt noise reading on AC voltmeter.
- 3-3-6 Connect the R.F. Signal Generator to the antenna input jack. Turn modulation off. Set the generator to the operating crystal frequency.
- 3-3-7 Adjust the Signal Generator output until the voltmeter reads 0.2 volts.
- 3-3-8 Adjust T101 (top core) and T101 (bottom core), for maximum quieting (lowest meter reading). Adjust Signal Generator to maintain reading on AC voltmeter between 0.1 and 0.2 volts. If two peaks occur, use the one away from the center of the coil form.
- 3-3-9 Set the generator frequency to the secondary image frequency. This is 910 KHz ABOVE the channel frequency.

NOTE: Some receivers may have the second oscillator at 11.155 MHz, if this is the case, the image frequency is 910 KHz BELOW the channel frequency. Check the frequency marked on top of the crystal (10.245 MHz for above and 11.155 MHz for below).

- 3-3-10 Adjust the Signal Generator output until voltmeter reads 0.2 volts.
- 3-3-11 Adjust T102 (bottom core), T102 (top core), T101 (bottom core) and T101 (top core) (in that order) for maximum quieting degradation (highest meter reading). Adjust Signal Generator output to maintain voltmeter reading between 0.1 and 0.2 volts. The correct position for the cores should be within two turns of the position in step No. 4 and 8.

3-4 RF (RECEIVER) ALIGNMENT

- 3-4-1 Pre-set L104 flush with top of coil form.
- 3-4-2 Connect AC voltmeter across the speaker terminals.
- 3-4-3 With nothing connected to the antenna input, adjust the volume control until AC voltmeter reads 1 volt of noise.
- 3-4-4 Connect Signal Generator to antenna input jack. Set generator accurately to the center frequency of the channel being used for alignment. Turn modulation off.
- 3-4-5 Adjust output of Signal Generator until AC voltmeter reads 0.2 volts.

- 3-4-6 Adjust L101, L102 and L103, in that order, for maximum quieting (lowest meter reading). Adjust Signal Generator output to maintain voltmeter reading between 0.1 and 0.2 volts. Repeat adjustments until no further improvement can be made. If two peaks occur on any core, use the peak with the core nearest the top of the coil form.
- 3-4-7 Adjust L104 for maximum quieting (lowest meter reading). Adjust Signal Generator to maintain reading on AC voltmeter between 0.1 and 0.2 volts. If two peaks occur, use the one away from center of the coil form.

3-5 NOISE BALANCE ADJUSTMENT

NOTE: This adjustment may be required only if excessive "ignition noise" is encountered. Usually, the noise problem is caused by improper or inadequate noise suppression of the vehicle's ignition system.

- 3-5-1 Using a "T" connector, connect the FM Signal Generator and the Noise Generator to the Antenna input jack. If a "T" connector is not available, connect the FM generator to the antenna jack and feed in the noise signal by means of a 3 or 4 turn loop coupled to the input coil, L101.
- 3-5-2 Connect the oscilloscope to the junction of Q112 emitter and Q113 collector, or to the speaker terminals.
- 3-5-3 Apply a 3 to 10 microvolt signal, as accurately as can be set to the exact channel frequency (carrier only, no modulation), and adjust the output of the noise generator until spikes are clearly seen in the audio output as viewed on the oscilloscope. The noise spikes will be either mostly positive or negative if an unbalanced condition exists.
- 3-5-4 Tune L108 (Quadrature Detector Coil) until the noise spikes are equally positive and negative in their amplitude. The overall amplitude of these spikes should be much less as a balance is achieved. Usually, only a 1/4 turn, or less, is needed to obtain the proper adjustment for best noise balance. If a proper balance can not be achieved, repeat the IF and RF alignments and then try the noise balance adjustment again.

3-6 EQUIPMENT REQUIRED—TRANSMITTER ALIGNMENT

- 3-6-1 RF Wattmeter (or any equivalent device which provides a 50 ohm load at the appropriate power range).
- 3-6-2 Frequency Counter - 50 MHz required.

- 3-6-3 FM Modulation Meter - Lampkin 205A or equivalent peak reading deviation meter.
- 3-6-4 Audio Generator - HP 200D or equivalent.
- 3-6-5 VTVM (See 3-7-4 below).
- 3-6-6 Oscilloscope

3-7 TRANSMITTER TUNING PROCEDURE

NOTE: The encircled numbers on diagram 4-7 correspond to the last digit in the following procedure steps. The unit must be connected to a suitable 50 Ω load for proper alignment of the final transmitter stage.

- 3-7-1 Install crystals. For full bandwidth alignment, a center tune-up crystal must be used. Alignment is done on the center tune-up frequency and then the bandwidth is checked using the high and low crystals. The total maximum bandwidth for Transmitter operation is 1.0 MHz (500 KHz above and 500 KHz below the tune-up frequency).

Because of the extremely wide frequency range over which this transmitter is required to operate (29-50 MHz), it has been necessary to divide the frequency band into seven sub-bands, each 3 MHz wide. Each sub-band has its own set of tuning capacitors, which are listed in a table on the schematic diagram. The table also shows the change in L202 and L206 between the high and low portions of the band.

By dividing the band into seven small segments instead of the usual two or three large ones, it has been possible to provide the tuned circuits with the correct L-to-C ratio and circuit "Q" for optimum operation at all frequencies. In this manner the compromises necessary to achieve wide tuning range have been eliminated.

- 3-7-2 Tighten trimmer capacitors C217 and C218 to maximum clockwise position (maximum capacitance).
- 3-7-3 Loosen trimmer capacitor C252 to near minimum capacitance (counter-clockwise).

The adjustment of C252 need only be made once and is not affected by the other adjustments in the Output Matching Network, nor by changing to another frequency in the sub-band. Consequently, if the transmitter has ever been aligned before, it will not be necessary to re-adjust C252 and all steps pertaining to this adjustment in the following paragraphs should be omitted. This adjustment is normally made at the factory near the center of the sub-band and then sealed.

- 3-7-4 Set warping capacitors C246, C248, C250 and C252 to mid-range capacitance (1/2 open).

In the following procedure, key the transmitter momentarily, while each adjustment is being made. Do not leave in a continuously keyed state until alignment is complete.

Required equipments are a 50 ohm resistive load termination rated at 50 watts or more, an RF wattmeter, and a VTVM in which the reference (ground or common) lead can be "floated" above ground (a Battery Powered unit or an AC Powered unit with the "common" isolated from chassis ground).

3-7-5 Oscillator Check

- a. Connect the probe of the VTVM to the Emitter of Q212 (common connected to ground).
- b. If the oscillator is running, the voltage at this point will be about 1.7 VDC. If it is not running, the voltage will be about 1.3 VDC.

3-7-6 Modulator Alignment

- a. Connect the common lead of the VTVM to the A+ buss in the transmitter (Junction of R237, R231, etc.).
- b. Connect the probe of the VTVM to the junction of R237 and T206. Short this point to the collector of Q211 with a jumper.
- c. Tune the core of L206 for peak on the VTVM (maximum voltage drop across R237). Normal voltage is -0.8 volts.
- d. Remove the jumper.

- 3-7-7 T206: The common lead of the VTVM is left connected to the A+ buss during the remainder of the alignment. Before proceeding, back all of the bottom cores of transformers T202 through T206 until the cores are flush with the bottom of the P.C. board. Connect the VTVM probe to the junction of R231 and T205. Connect a jumper between this point and the collector of Q209. Tune the primary (top core) of T206 for a peak reading on the VTVM (max. voltage drop across R231), and then adjust the bottom core of T206 for a peak reading. Normal voltage is -1.8 volts. Remove the jumper. In adjusting T203 through T206, the secondary (top core) is first peaked with the primary (bottom core) backed out of its winding, and then the primary is tuned. The secondary is not to be readjusted after the primary is tuned.

- 3-7-8 T205: Connect the VTVM probe to the junction of R225 and T204. Jumper this point to the collector of Q207. Adjust the secondary core and then the primary core for a peak reading on the VTVM as in 5a. above. Remove the jumper. Normal voltage is -3.5 volts.
- 3-7-9 T204: Connect the VTVM probe to the junction of R223 and T203. Jumper this point to the collector of Q206. Adjust the secondary core and then the primary core for a peak reading as in 5a. above. Remove the jumper. Normal voltage is -1.2 volts.
- 3-7-10 T203: Connect the VTVM probe to the junction of R220 and T302. Jumper this point to the collector of Q205. Adjust the secondary and primary cores of T203 as in 5a. above, then remove the jumper. Normal voltage is -1.0 volts.
- 3-7-11 T202: Adjust the primary (bottom core) of T202 for a dip in the reading of the VTVM. Then adjust both primary and secondary cores for maximum RF power output as indicated on the voltmeter.

3-7-12 Power Amplifier Alignment

- a. The following adjustments are peaked in the order listed for maximum power output as indicated on the R.F. wattmeter.
 - 1.) C218
 - 2.) C217
 - 3.) T202, primary & secondary
 - 4.) Repeat the above three steps until no further improvement is noted.
- b. Second Harmonic Trap Adjustment: C252 is adjusted for minimum second harmonic output as observed by a spectrum analyzer or other means. Repeak C217 and C218 for maximum power out. Repeat these three steps until no further improvement is noted. Once aligned at one frequency, the second harmonic trap need not be re-aligned for other frequencies within the same sub-band.
- c. Check power output on all the crystals installed in the BTL-304. Adjust T202 for the best compromise in RF power output between the highest and lowest channels. Minimum rated power output is 30 watts at a 13.8 VDC.
- d. It is desirable, during Power Amplifier Alignment, to place the unit, especially the transmitter section, on a sheet of steel to simulate the presence of the unit's cover. This sheet should be large enough so that it completely covers the bottom of the transmitter board and protrudes beyond the chassis on both sides. Do not permit this sheet to touch any part protruding below the transmitter board.

3-8 CRYSTAL NETTING PROCEDURE

NOTE: The following procedures must be performed with the radio set at a temperature of 70 to 80°F. The frequency of each channel must be set to within $\pm .0001\%$ of the assigned channel frequency.

- 3-8-1 Connect the unit to the RF wattmeter or dummy load.
- 3-8-2 Turn transmitter on (key the mike's PTT switch or ground pin No. 1 of J2).
- 3-8-3 Place an RF pick-up loop consisting of 3 or 4 turns near the final transistor's output circuit (near L201; See diagram 4-5).
- 3-8-4 Read the frequency on the counter.
- 3-8-5 Adjust the appropriate netting capacitor (C246 through C252; See diagram 4-9 for their location) until the frequency being read on the counter is "on" channel.

3-9 DEVIATION AND MIKE GAIN ADJUSTMENT

- 3-9-1 Use the following procedure for proper adjustment of the Mike Gain (R204) and Deviation (R216) control (See diagram 4-9 for their location):
 - a. Connect the unit to the RF wattmeter or dummy load.
 - b. Connect the scope probe to the junction of R211 and CR201. See 4-5 for location. It may be more convenient to connect the probe to the cathode lead of CR202.
 - c. Key the transmitter and talk into the microphone with a normal voice level. Observe the waveform on the scope and adjust R204 (Mike Gain) until approximately 10% of the voice peaks are clipped.
 - d. Connect the audio generator to the mike input terminals. Set the audio voltage level to 0.5 - 1.0 volts RMS at 400 Hz.
 - e. Couple the FM Modulation Meter's RF pick up to the transmitter.
 - f. Key the transmitter and adjust R216 (Deviation Control) so that the maximum deviation is no greater than ± 5 KHz.
 - g. Reduce the audio input level to 0.25 volts RMS. The deviation should not be greater than ± 5 KHz.

SECTION 4 DIAGRAMS, VOLTAGE DATA AND SCHEMATICS

4-1 RECEIVER BOARD PARTS PLACEMENT DIAGRAM

4-2 RECEIVER BOARD BOTTOM VIEW

4-3 LED DISPLAY BOARDS PARTS PLACEMENT DIAGRAMS

4-4 LED DISPLAY BOARDS BOTTOM VIEWS

4-5 TRANSMITTER BOARD PARTS PLACEMENT DIAGRAM

4-6 TRANSMITTER BOARD BOTTOM VIEW

4-7 TRANSMITTER BOARD TUNE-UP TEST POINTS

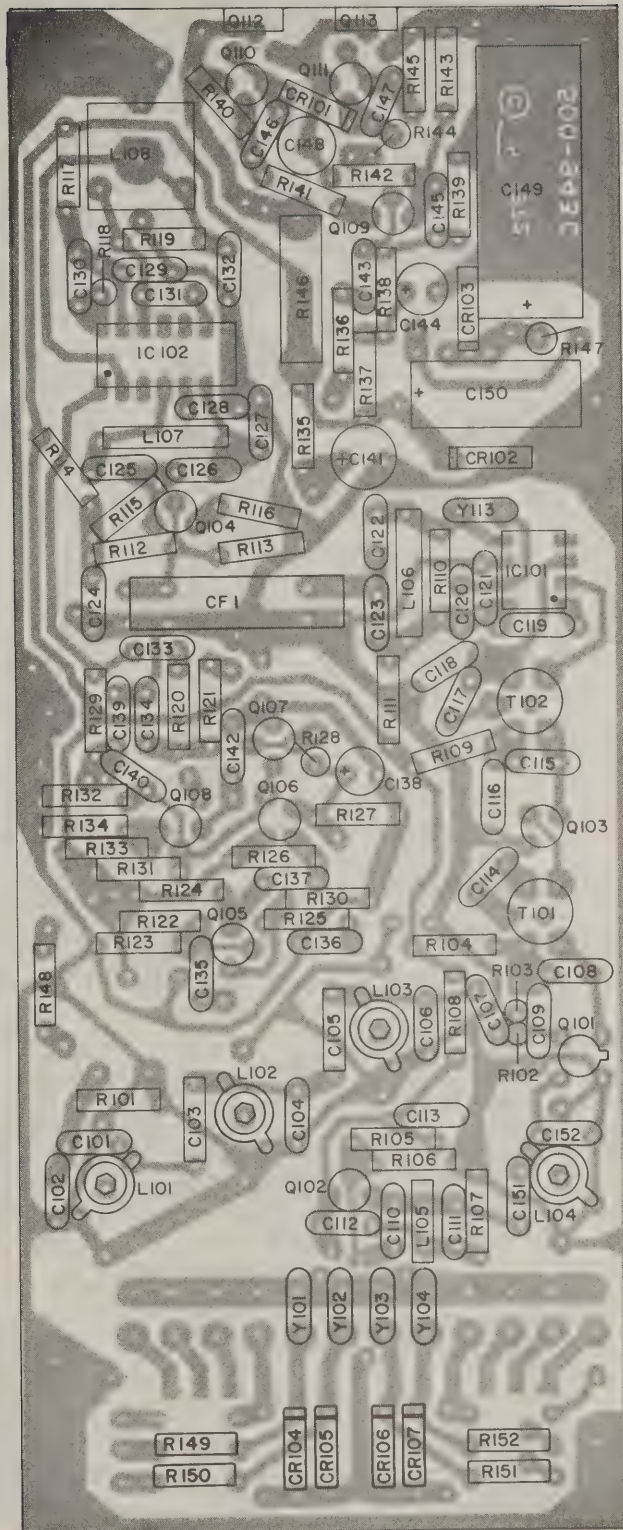
4-8 VOLTAGE DATA AND SEMI-CONDUCTOR LOCATION DIAGRAM

4-9 CRYSTAL LOCATION AND ADJUSTMENT DIAGRAM

4-10 SCHEMATIC WITH VOLTAGES (BTL-301)

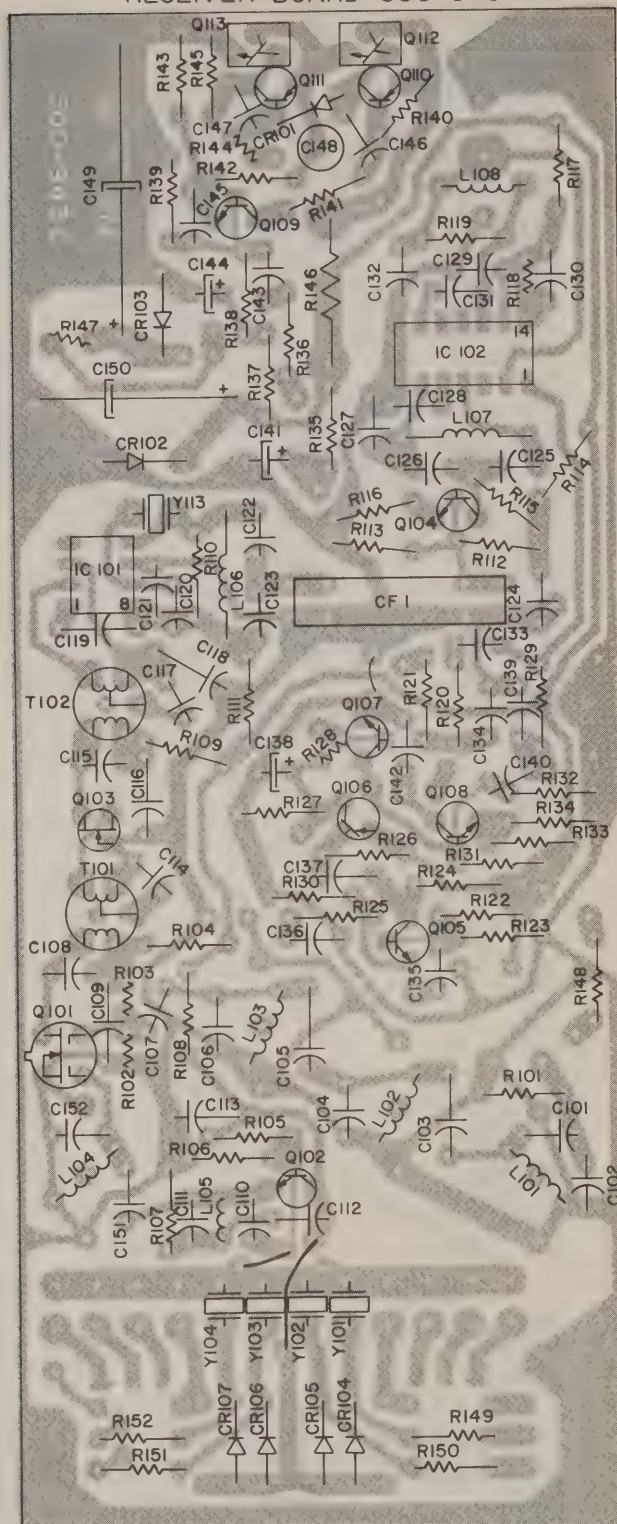
4-11 SCHEMATIC WITH VOLTAGES (BLT-304)

RECEIVER BOARD 500-943



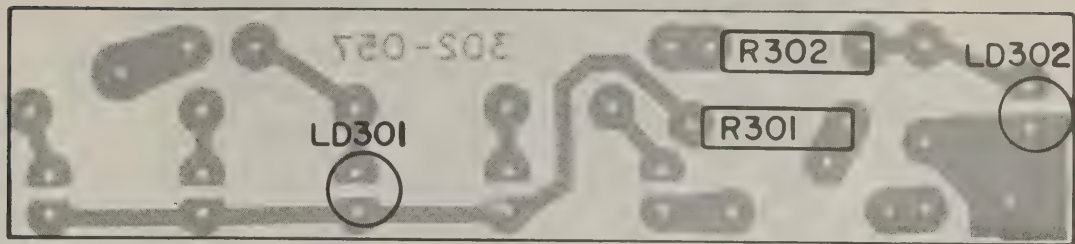
4-1 RECEIVER BOARD PARTS PLACEMENT DIAGRAM

RECEIVER BOARD 500-943



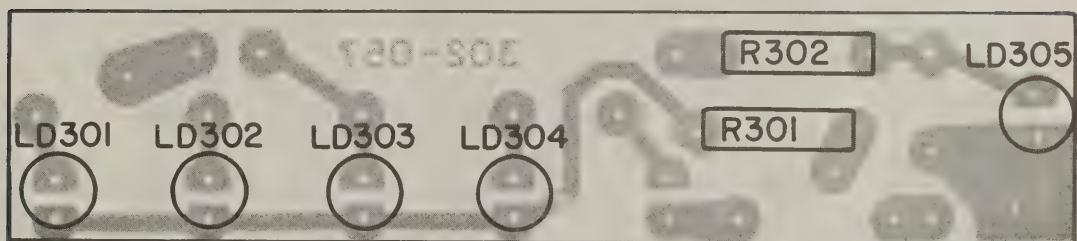
4-2 RECEIVER BOARD BOTTOM VIEW

L.E.D. DISPLAY BOARD 302-057



BTL-301

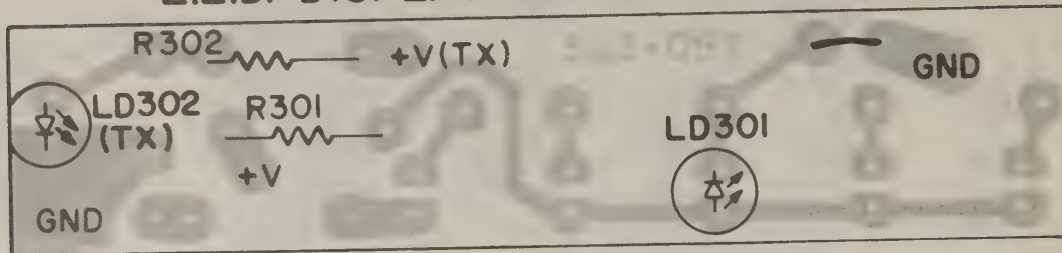
L.E.D. DISPLAY BOARD 302-057



BTL-304

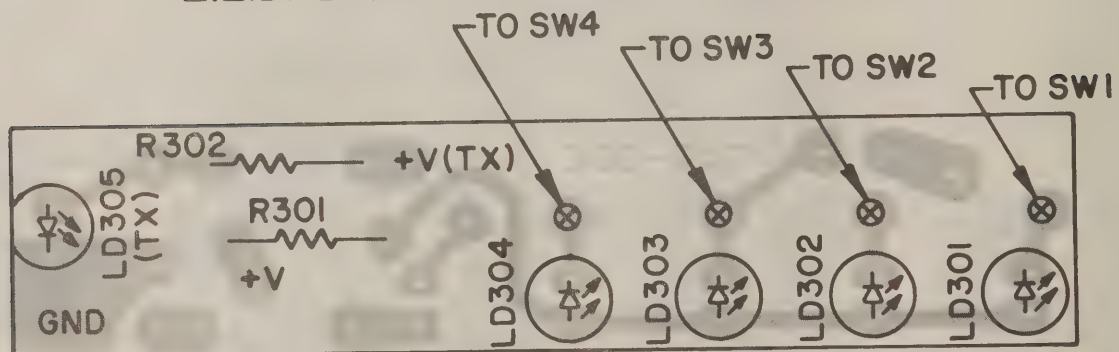
4-3 LED DISPLAY BOARDS PARTS PLACEMENT DIAGRAMS

L.E.D. DISPLAY BOARD 302-057



BTL-301

L.E.D. DISPLAY BOARD 302-057

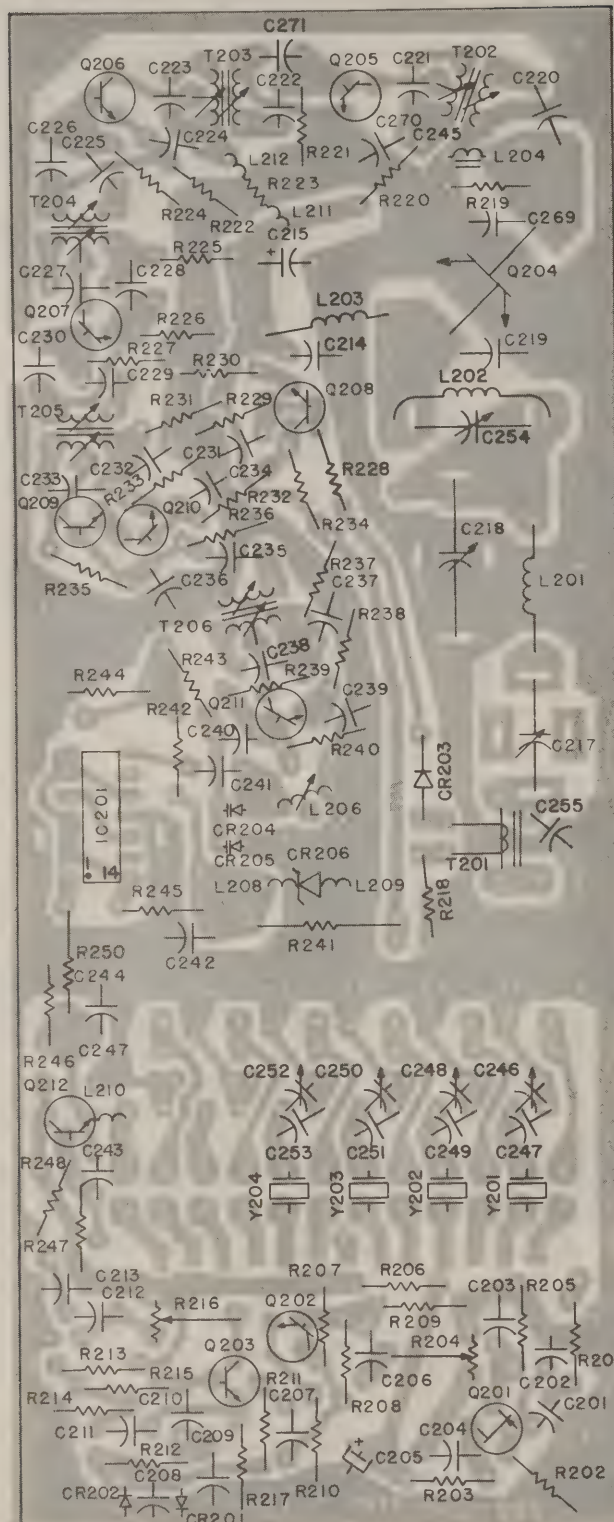


BTL-304

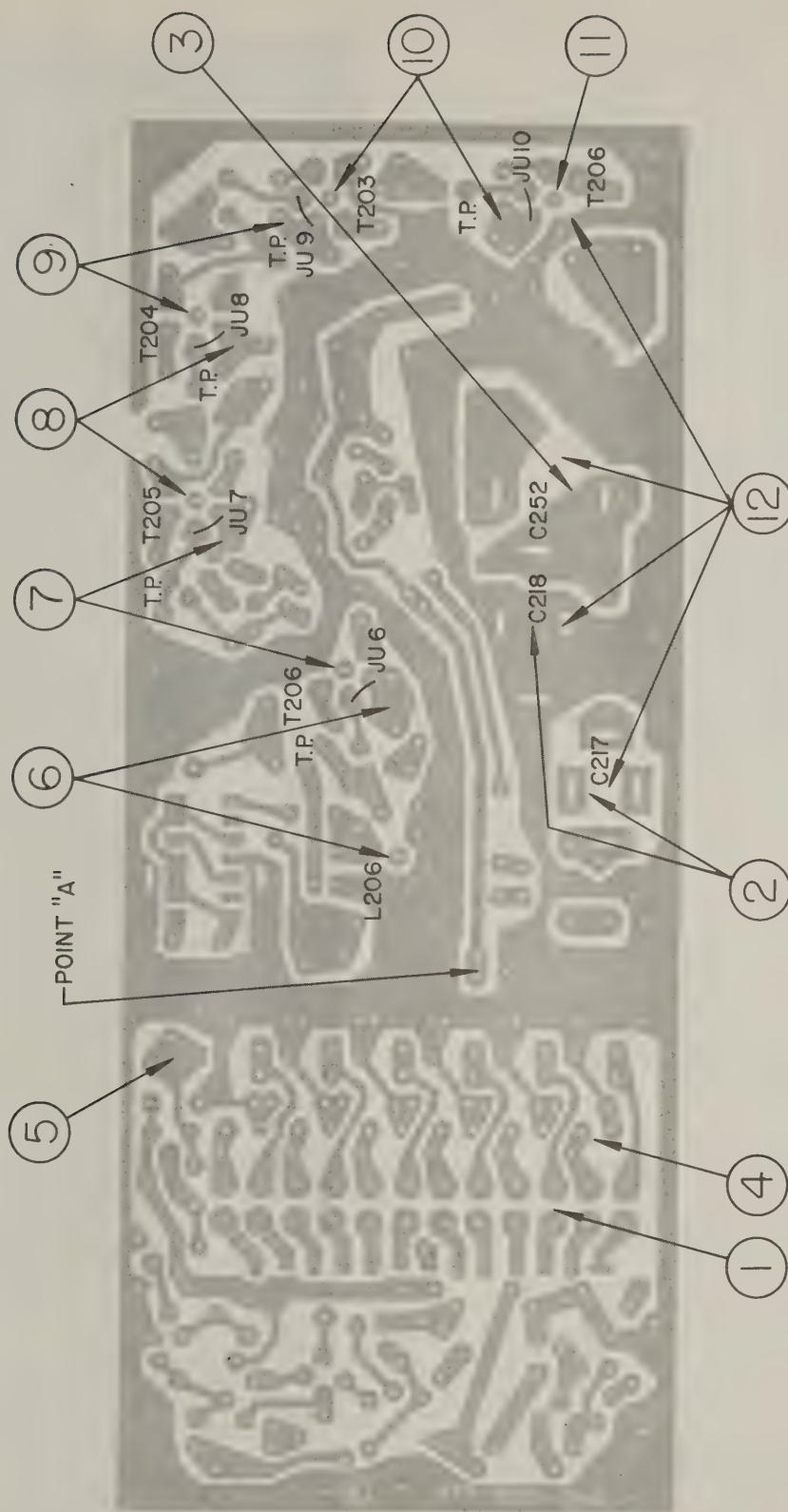
4-4 LED DISPLAY BOARDS BOTTOM VIEWS

BTL-301 & BTL-304

TRANSMITTER BOARD 500-996



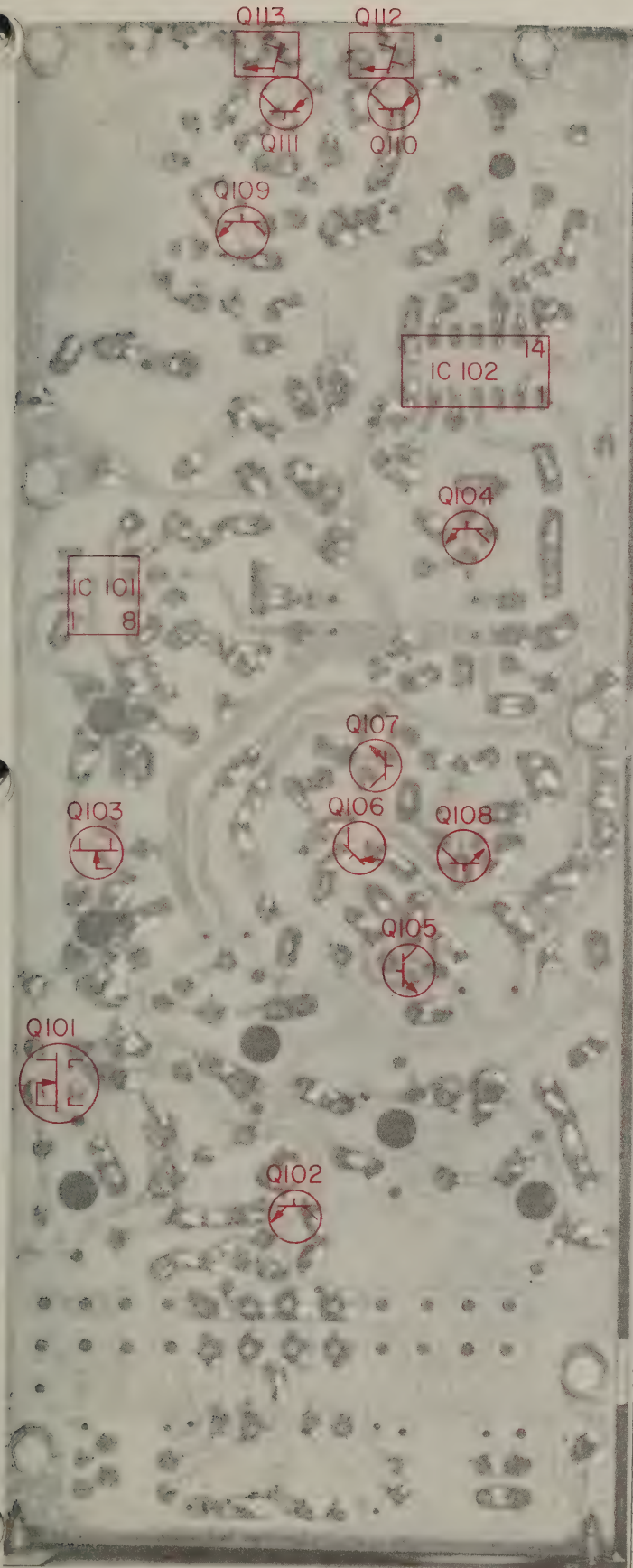
4-6 TRANSMITTER BOARD BOTTOM VIEW



4-7 TRANSMITTER BOARD TUNE-UP TEST POINTS

OR LOCATION DIAGRAM

sure with a VTVM.
o the power cable



Base (Gate)	Collector (Drain)
51: 0	4.5
52: 0.8	
4.4	7.8
0	6.8
1.1	4.5
1.7	4.8
8.2	0 (unsquelched)
8.2	1.0 (squelched)
8.2	1.5 min. (tight squelch)
0	1.9 (unsquelched)
0.80	0.30 (squelched)
0.80	0.10 (tight squelch)
1.9	5.1 (unsquelched)
0.10	8.2 (tight squelch)
1.3	12.4
13.2	7.4
6.6	0.10
7.4	13.8
0.10	6.8
0	5
0.5	4.6
0.65-0.90	6.0* (Varies with setting of R216)
0	13.0
-0.2	11.3
-0.05	12.1
-0.9	11.3
0.2	1.0
-0.5	11.1
0.9	0.2
1.0	12.4
—	8.2

UNITS

receiver Board, 500-943; IC201 is located on the TX Board

8	9	10	11	12	13	14
8				—	—	
0	0.2	1.4	2.9	3.5	7.6	5.0
	—	5.0	0	—	—	5.0



4-8 VOLTAGE DATA AND SEMI-CONDUCTOR LOCATION DIAGRAM

NOTE: All voltages are nominal and are measure with a VTVM.
13.8 VDC Supply Voltage at input to the power cable
supplied with the unit.

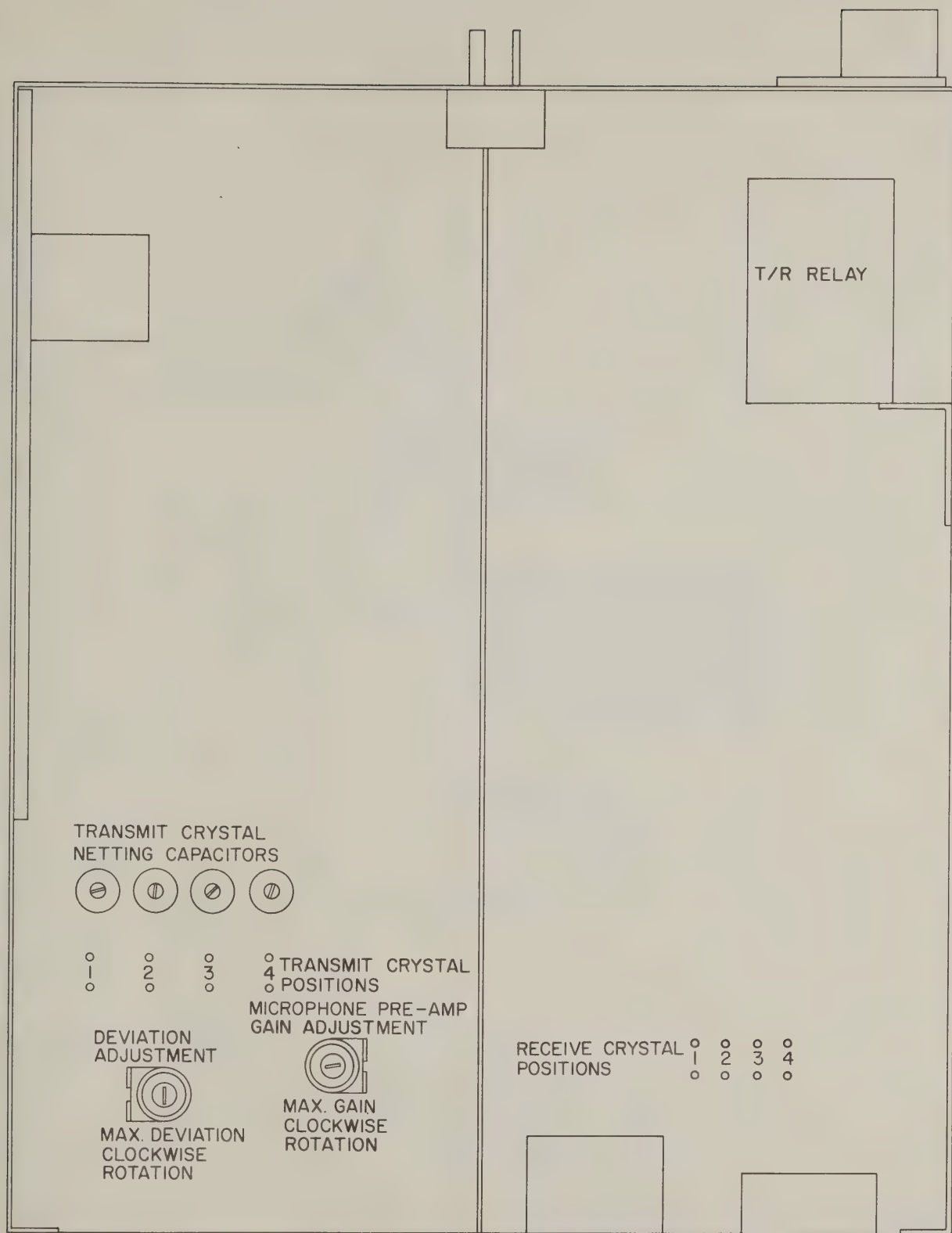
VOLTAGE DATA – TRANSISTORS

	Transistor	Emitter (Source)	Base (Gate)	Collector (Drain)
Receiver Board No. 500-943	Q101(FET)	0	G1: 0 G2: 0.8	4.5
	Q102	3.8	4.4	7.8
	Q103(FET)	0	0	6.8
	Q104	0.4	1.1	4.5
	Q105	1.0	1.7	4.8
	Q106(PNP)	8.2	8.2	0 (unsquelched)
		8.2	8.2	1.0 (squelched)
		8.2	8.2	1.5 min. (tight squeleh)
	Q107	0	0	1.9 (unsquelched)
		0	0.80	0.30 (squelched)
		0	0.80	0.10 (tight squeleh)
	Q108	1.4	1.9	5.1 (unsquelched)
		1.1	0.10	8.2 (tight squeleh)
	Q109	0.7	1.3	12.4
	Q110(PNP)	13.8	13.2	7.4
	Q111(PNP)	6.8	6.6	0.10
	Q112	6.8	7.4	13.8
	Q113	0	0.10	6.8
TX BOARD 500-996	Q201(FET)	0.8	0	5
	Q202	0.2	0.5	4.6
	Q203	0.15-0.30	0.65-0.90	6.0* (Varies with setting of R216)
	Q204	0	0	13.0
	Q205	0	-0.2	11.3
	Q206	0.9	-0.05	12.1
	Q207	1.0	-0.9	11.3
	Q208	0	0.2	1.0
	Q209	0.2	-0.5	11.1
	Q210	0.2	0.9	0.2
	Q211	0.9	1.0	12.4
	Q212	1.7	—	8.2

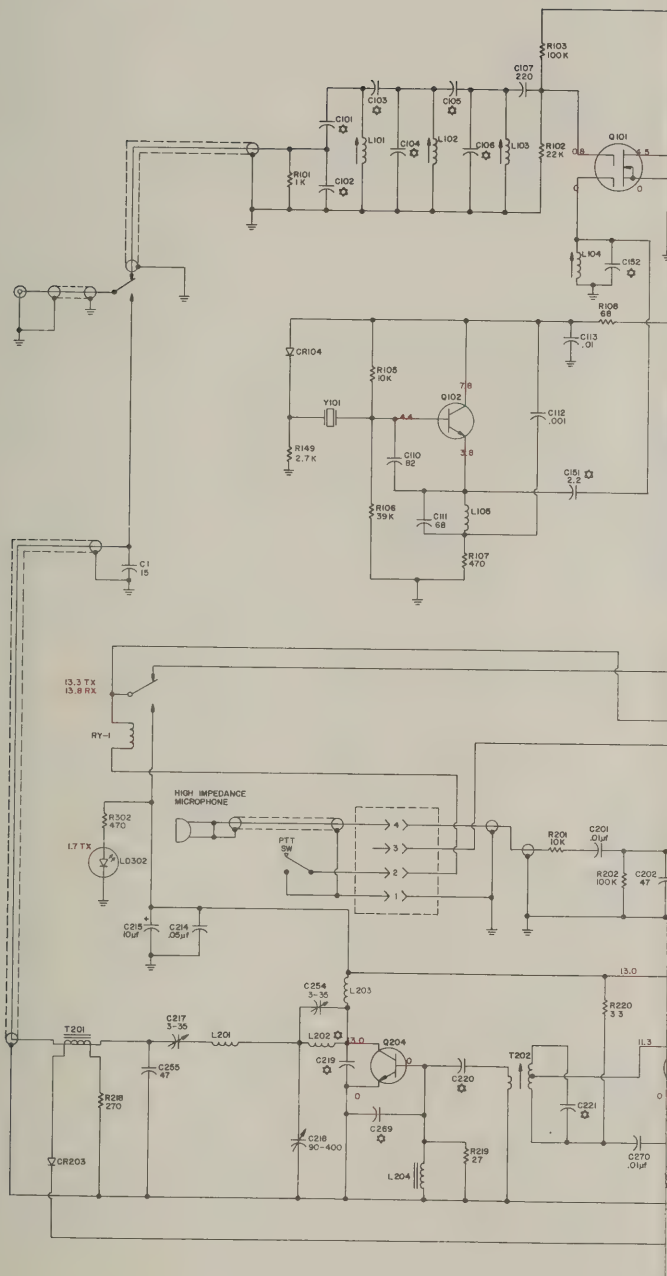
VOLTAGE DATA—INTEGRATED CIRCUITS

NOTE: IC1014 IC102 are located on the receiver Board, 500-943; IC201 is located on the TX Board

IC. No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
IC 101	4.2	0.7	0.7	4.2	7.8	0	4.2	7.8	—	—	—	—	—	—
IC 102	4.0	3.5	0	1.3	1.3	1.3	0	0	0.2	1.4	2.9	3.5	7.6	5.0
IC 201	5.0	5.0	5.0	5.0	—	5.0	5.0	—	—	5.0	0	—	—	5.0



4-9 CRYSTAL LOCATION AND ADJUSTMENT DIAGRAM



33	C104	C105	C106	C101	C102
2	27	1.2	2.2	2.7	15
0	18	82	12	2.2	10
2	10	82	6.2	2.2	8.2

33	C230	C225	C227	C226	C225	C223	C222	C221	C220	C219	C209	L208	L202
10	1000	360	150	470	220	100	120	360	390	220	820	301-892	302-086
10	1000	300	150	470	220	82	100	270	360	220	820	301-892	302-086
10	1000	270	100	360	150	68	82	250	300	220	820	301-892	302-086
10	1000	250	100	360	150	56	75	200	250	220	470	301-892	302-086
10	470	220	82	360	100	47	56	180	200	82	470	302-083	102-742
0	470	180	75	360	82	47	56	150	180	82	470	302-083	102-742
0	470	180	75	360	82	36	47	120	150	82	470	302-083	102-742

NOT SPECIFIED ARE PCO-FARAD.
 NOT SPECIFIED ARE OHMS, 1/4 WATT.
 FACTORY SELECTED, NOMINAL VALUES SHOWN.
 OF COMPONENTS NOTED *.
 AND L212 ARE FERRITE BEADS PLACED OVER
 IN RED) ARE NOMINAL VALUES AS MEASURED
 VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE
 A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
 RESHOLD
 HT
 IN TRANSMITTER SECTION ARE MEASURED WITH THE
 OPERATION AND CONNECTED TO A PROPER LOAD.

OMATIC WITH VOLTAGES (BTL-301)



FREQUENCY	C101	C102	C103	C104	C105	C106	C151
30-35 MHZ	33	300	1.2	27	1.2	2.2	2.7
35-44 MHZ	22	220	1.0	18	.82	12	2.2
44-50 MHZ	15	150	.82	10	.82	6.2	2.2

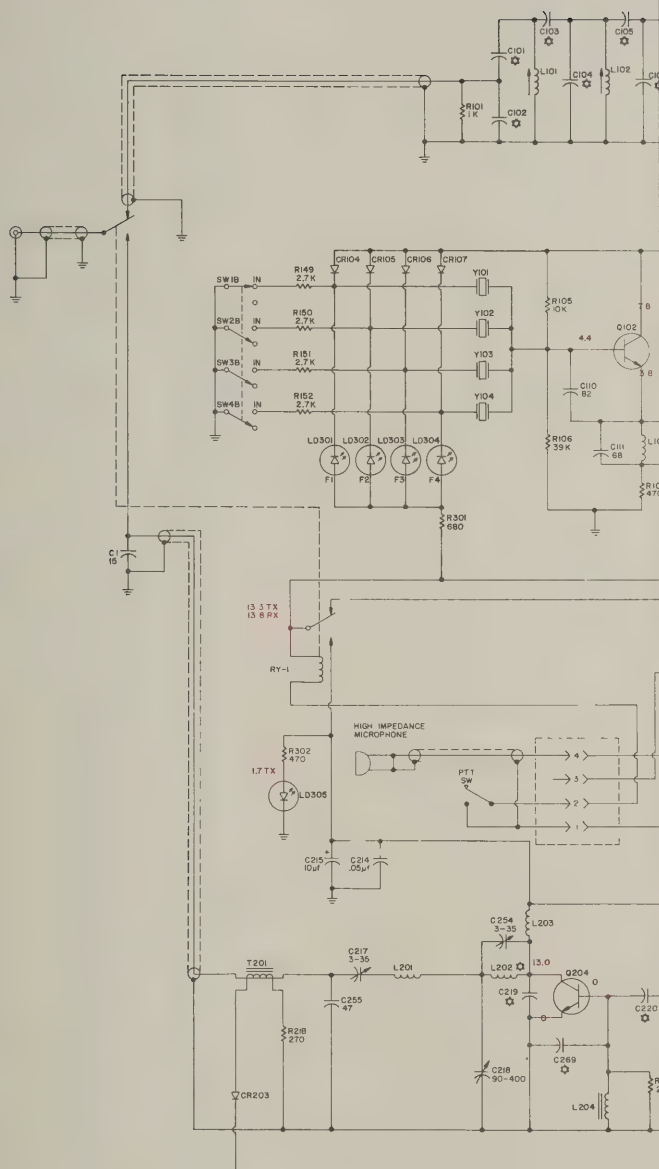
TRANSMITTER

FREQUENCY	C238	C239	C213	C330	C219	C227	C228	C223	C225	C222	C231	C220	C216	C289	C206
32-33 MHz	390	660	360	1000	340	150	470	320	100	180	340	220	620	30	30
33-35 MHz	390	560	360	1000	340	150	470	320	100	180	340	220	620	30	30
35-36 MHz	390	560	360	1000	340	150	470	320	100	180	340	220	620	30	30
36-38 MHz	360	560	360	1000	270	100	360	150	69	62	250	500	220	620	30
38-41 MHz	270	390	320	1000	250	100	360	150	58	75	200	250	220	470	30
41-44 MHz	270	390	320	100	220	62	360	100	45	56	180	200	62	470	30
44-47 MHz	180	220	180	470	180	75	360	62	45	56	180	62	470	30	30
47-50 MHz	180	220	180	470	180	75	360	62	36	47	20	180	62	470	30

NOTES:

1. ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD.
ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT.
2. NOTED VALUES ARE FACTORY SELECTED. NOMINAL VALUES SHOWN
3. SEE TABLES FOR VALUES OF COMPONENTS NOTED \square .
4. L209, L272, L212, AND L212 ARE FERRITE BEADS PLACED OVER
COMPONENT LEADS.
5. ALL VOLTAGES (FIGURES IN PAREN) ARE NOMINAL VALUES AS MEASURED
WITH A VTVM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE
SUPPLY WITH LOAD.
6. LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
u = UNSQUELCHED
s = SQUELCHED - THRESHOLD
t = SQUELCHED - THRESH
b. VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE
TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD.

4-10 SCHEMATIC WITH VOLTAGES (BTL-301)



RECEIVER

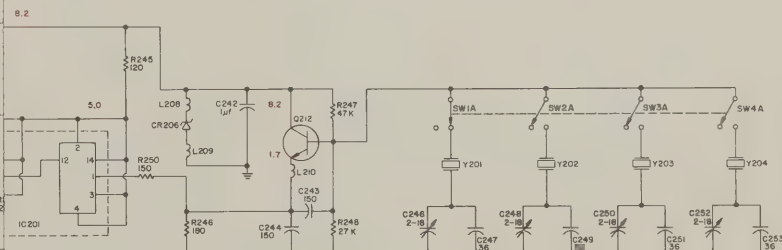
FREQUENCY	C101	C102	C103	C104	C105	C106	C107	C108
30-35 MHz	33	300	1.2	27	1.2	22	2.7	15
35-44 MHz	22	220	1.0	18	.82	12	2.2	10
44-50 MHz	15	150	.82	10	.82	8.2	2.2	8.2

TRANSMITTER

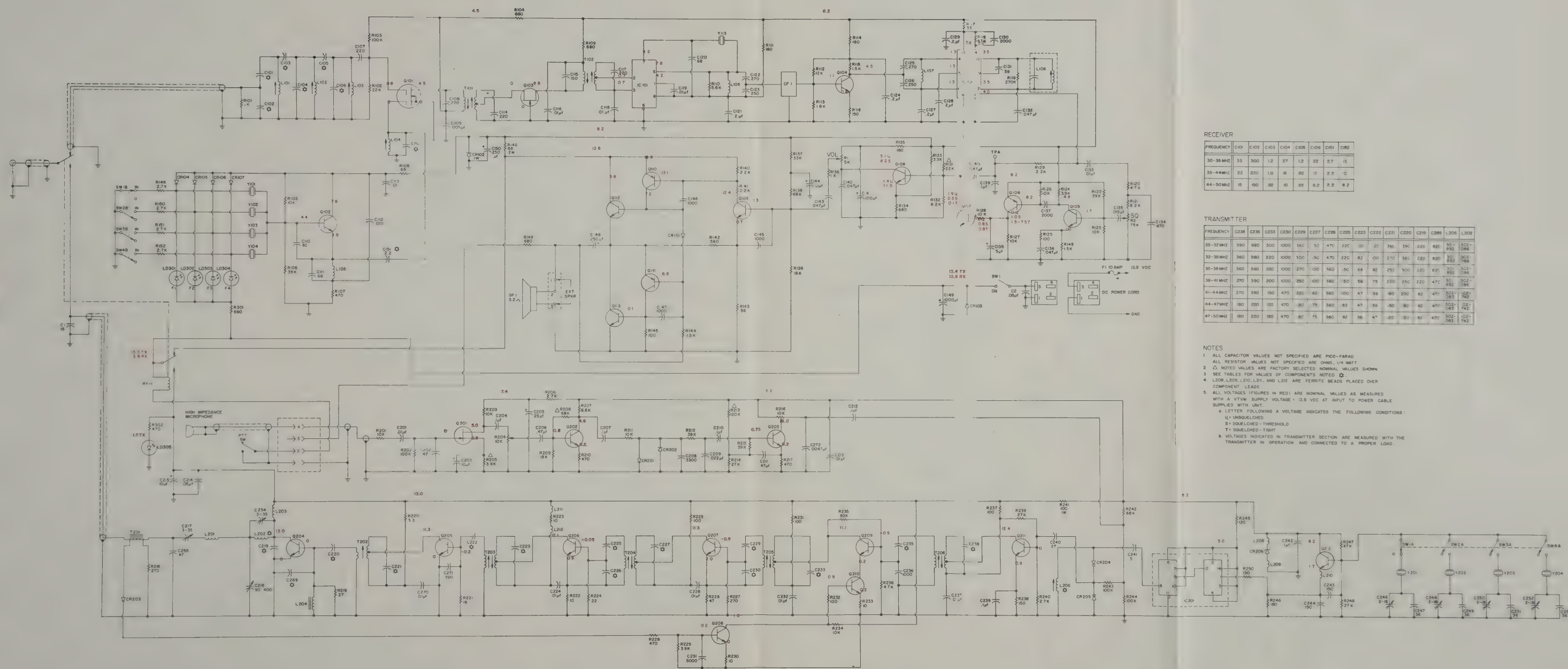
FREQUENCY	C238	C235	C233	C230	C229	C227	C226	C225	C223	C222	C221	C220	C219	C209	L206	L202
29-32 MHz	390	880	300	1000	360	150	470	220	100	120	360	390	220	820	301-892	302-086
32-35 MHz	360	560	220	1000	300	150	470	220	82	100	270	360	220	820	301-892	302-086
35-38 MHz	360	560	220	1000	270	100	360	150	68	82	250	300	220	820	301-892	302-086
38-41 MHz	270	390	200	1000	250	100	360	150	56	75	200	250	220	470	301-892	302-086
41-44 MHz	270	390	150	470	220	82	360	100	47	56	180	200	82	470	302-083	102-742
44-47 MHz	180	220	120	470	180	75	360	82	47	56	150	180	82	470	302-083	102-742
47-50 MHz	180	220	120	470	180	75	360	82	56	47	120	150	82	470	302-083	102-742

NOTES:

- ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD.
- ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT.
- NOTED VALUES ARE FACTORY SELECTED, NOMINAL VALUES SHOWN.
- SEE TABLES FOR VALUES OF COMPONENTS NOTED.
- L206, L209, L210, L211, AND L212 ARE FERRITE BEADS PLACED OVER COMPONENT LEADS.
- ALL VOLTAGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED WITH A VTVM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE SUPPLIED WITH UNIT.
- LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
 - U = UNSQUELCHED
 - S = SQUELCHED - THRESHOLD
 - T = SQUELCHED - TIGHT
- VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD.



4-11 SCHEMATIC WITH VOLTAGES (BLT-304)



RECEIVER

FREQUENCY	C101	C102	C103	C104	C105	C106	C107	C108
30-35 MHz	33	300	1.2	27	1.2	22	2.7	15
35-44 MHz	22	220	1.0	18	82	10	2.2	10
44-50 MHz	15	150	82	10	82	6.2	2.2	8.2

TRANSMITTER

FREQUENCY	C238	C236	C233	C230	C229	C227	C226	C225	C223	C221	C220	C219	C209	C206	C202
29-32 MHz	390	680	300	1000	160	50	470	220	100	20	56	390	280	820	302
32-35 MHz	360	580	220	1000	100	50	470	220	82	100	270	360	220	820	302
35-38 MHz	360	580	220	1000	270	100	160	50	68	82	250	100	220	820	302
38-41 MHz	270	390	200	1000	280	100	160	50	56	75	200	250	220	470	302
41-44 MHz	270	390	150	470	220	82	360	100	47	56	180	200	82	470	302
44-47 MHz	180	220	120	470	80	75	360	82	47	56	150	180	82	470	302
47-50 MHz	180	220	120	470	80	75	360	82	36	47	120	150	82	470	302

NOTES

- ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD.
- ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT.
- NOTED VALUES ARE FACTORY SELECTED NOMINAL VALUES SHOWN.
- SEE TABLES FOR VALUES OF COMPONENTS NOTED IN.
- LD01, LD02, LD03, LD04, AND LD05 ARE FERRITE BEADS PLACED OVER COMPONENT LEADS.
- ALL VOLTAGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED WITH A VTVM SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE SUPPLIED WITH UNIT.
- LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
U: UNQUENCHED
S: SOULDED - THRESHOLD
T: SOULDED - TIGHT
- VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD.

4-11 SCHEMATIC WITH VOLTAGES (BLT-304)

SECTION 5 PARTS LIST

5-1 RECEIVER BOARD 500-943

Item	Description	Part No.
------	-------------	----------

RESISTORS

All Resistors are $\pm 10\%$, $\frac{1}{4}W$, unless otherwise noted.

R101	1K
R102	22K
R103	100K
R104	680 ohm
R105	10K
R106	39K
R107	470 ohm
R108	330 ohm
R109	680 ohm
R110	5.6K
R111	180 ohm
R112	12K
R113	1.8K
R114	180 ohm
R115	1.5K
R116	150 ohm
R117	33 ohm
R118	47K
R119	270K
R120	4.7K
R121	8.2K
R122	39K
R123	10K
R124	3.9K
R125	100 ohm
R126	10K
R127	10K
R128	10K
R129	2.2K
R130	1.5K
R131	22K
R132	8.2K
R133	3.3K
R134	680 ohm
R135	180 ohm
R136	1K
R137	33K
R138	68K
R139	18K
R140	2.2K
R141	2.2K
R142	560 ohm
R143	56 ohm
R144	1.5K
R145	100 ohm
R146	68 ohm, 2W, 5%
R148	680 ohm

Item	Description	Part No.
------	-------------	----------

CAPACITORS

C101	*	
C102	*	
C103	*	
C104	*	
C105	*	
C106	*	
C107	220pf, 5%, 50V (Mica)	1506-0221-550
C108	Same as C107	
C109	.005mf, +80 -20%, 500V Z5U (Disc.)	1503-0502-001
C110	82pf, 5%, 50V (Mica)	1506-0820-550
C111	68pf, 5%, 50V (Mica)	1506-0680-550
C112	.001mf, +80 -20%, 500V Z5U (Disc.)	1503-0102-001
C113	.01mf, +80 -20%, 500V Z5U (Disc.)	1503-0103-001
C114	220pf, 5%, 50V (Mica)	1506-0221-550
C115	150pf, 5%, 50V (Mica)	1506-0151-550
C116	.01mf, +80 -20%, 500V Z5U (Disc.)	1503-0103-001
C117	220pf, 5%, 50V (Mica)	1506-0221-550
C118	.01mf, +80 -20%, 500V Z5U (Disc.)	1503-0103-001
C119	Same as C118	
C120	68pf, 5%, 50V (Mica)	1506-0680-550
C121	.2mf, +80 -20%, 12V (Disc.)	1501-0204-006
C122	270pf, 5%, 50V (Mica)	1506-0271-550
C123	250pf, 5%, 50V (Mica)	1506-0251-550
C124	.2mf, +80 -20%, 12V (Disc.)	1502-0204-006
C125	270pf, 5%, 50V (Mica)	1506-0271-550
C126	250pf, 5%, 50V (Mica)	1506-0251-550
C127	.2mf, +80 -20%, 12V (Disc.)	1502-0204-006
C128	Same as C127	
C129	Same as C127	
C130	.002mf, 20%, 500V Z5U (Disc.)	1523-0202-001
C131	39pf, 10%, NPO, 500V	1500-0390-605
C132	.047mf, 10%, 100V (Mylar Film)	1508-0473-610
C133	.01mf, 10%, 100V (Mylar Film)	1508-0103-610
C134	470pf, 20%, 500V Z5U (Disc.)	1523-0471-001
C135	.015mf, 10%, 100V (Mylar Film)	1508-0153-610
C136	.047mf, 10%, 100V (Mylar Film)	1508-0473-610
C137	.002mf, 20%, 500V Z5U (Disc.)	1523-0202-001
C138	5mf, 85°C, 50V, (Electrolytic)	1513-0050-004
C139	.1mf, 20%, 12V (Disc.)	1502-0104-005
C140	.047mf, 10%, 100V (Mylar Film)	1508-0473-610
C141	100mf, 85°C, 10V (Electrolytic)	1513-0101-001
C142	.047mf, 10%, 100V (Mylar Film)	1508-0473-610
C143	Same as C142	
C144	10mf, 85°C, 10V (Electrolytic)	1513-0100-001
C145	.001mf, +80 -20%, 500V Z5U (Disc.)	1503-0102-001
C146	Same as C145	
C147	Same as C145	

Item No.	Description	Part No.
CAPACITORS		
C148	250mf, 85°C, 16V (Electrolytic)	1511-0251-002
C149	1000mf, 85°C, 16V (Electrolytic)	1511-0102-002
C150	250mf, 85°C, 10V (Electrolytic)	1511-0251-001
C151	*	
C152	*	
* The value of these capacitors depends on frequency and are given below:		
29-35MHz: Receiver Certification No. RL14A		
C101	33pf, 10%, 500V, NPO (Disc.)	1500-0330-605
C102	300pf, 5%, 50V (Mica)	1506-0301-550
C103	1.2pf, 10% (Composition)	1510-0129-900
C104	27pf, 10%, 500V, NPO (Disc.)	1500-0270-605
C105	1.2pf, 10% (Composition)	1510-0129-900
C106	22pf, 10%, 500V, NPO (Disc.)	1500-0220-605
C151	2.7pf, 10%, 500V, NPO (Disc.)	1500-0279-905
C152	15pf, 10%, 500V, NPO (Disc.)	1500-0150-605
35-44 MHz Receiver Certification No. RL14B		
C101	22pf, 10%, 500V, NPO (Disc.)	1500-0220-605
C102	220pf, 5%, 50V (Mica)	1506-0221-550
C103	1pf, 10% (Composition)	1510-0010-900
C104	18pf, 10%, 500V, NPO (Disc.)	1500-0180-605
C105	0.82pf, 10% (Composition)	1510-0828-900
C106	12pf, 10%, 500V, NPO (Disc.)	1500-0120-605
C151	2.2pf, ± 0.25 pf, NPO (Disc.)	1500-0229-205
C152	10pf, 10%, 500V, NPO (Disc.)	1500-0100-905
44-50 MHz: Receiver Certification No. RL14C		
C101	15pf, 10%, 500V, NPO (Disc.)	1500-0150-605
C102	150pf, 5%, 50V (Mica)	1506-0151-550
C103	0.82pf, 10% (Composition)	1510-0828-900
C104	10pf, 10%, 500V, NPO (Disc.)	1500-0100-905
C105	0.82pf, 10% (Composition)	1510-0828-900
C106	82pf, 10%, 500V, NPO (Disc.)	1500-0829-905
C151	2.2pf, ± 0.25 pf, NPO (Disc.)	1500-0229-205
C152	8.2pf, 10%, 500V, NPO (Disc.)	1500-0829-905
COILS		
L101	Coil RF (Yel)	1800-3191-402
L102	Same as L101	
L103	Same as L101	
L104	Coil RF (Wht)	1800-3191-401
L105	Coil TMR	1801-1236-900
L106	Coil. Shielded	1802-3182-700
L107	Same as L106	
L108	Coil	1800-3151-700
T101	Coil IF 10.7 Input	1800-3190-300
T102	Coil IF 10.7 Out	1800-3190-400
TRANSISTORS		
Q 101	MOS FET	4811-0000-001
Q102	Silicon NPN	4801-0000-100
Q103	Junct FET	4811-0000-030
Q104	Silicon NPN	4801-0000-010

Item No.	Description	Part No.
TRANSISTORS		
Q05	Same as Q104	
Q106	Silicon PNP	4801-0000-060
Q107	Silicon NPN	4801-0000-010
Q108	Same as Q107	
Q109	Same as Q107	
Q110	Silicon PNP	4801-0000-135
Q111	Same as Q110	
Q112	Silicon NPN Power	4802-0000-002
Q113	Same as Q112	
DIODES		
CR101	Diode, Silicon	4805-1241-200
CR102	Diode, Zener (8.2V)	4808-0000-009
CR103	Diode, Silicon Rectifier	4806-0000-004
INTEGRATED CIRCUITS		
IC101	IC, 10.7 IF	3130-3167-901
IC120	IC, 455 KHz Detector	3130-3157-603
FILTER		
CF-1	455 KHz Ceramic Filter	2700-0000-008
CRYSTAL		
Y113	10.245 MHz (301-516-1) or 11.155 MHz (301-516-2)	2301-3151-601 2301-3151-602

5-2 TRANSMITTER BOARD 500-996

Item No.	Description	Part No.	Item No.	Description	Part No.
RESISTORS			CAPACITORS		
All Resistors are $\pm 10\%$, $\frac{1}{4}W$, unless otherwise noted.			C201	.01mf, 10%, 100V (Mylar Film)	1508-0103-610
R201	10K		C202	47pf, 5%, 50V (Mica)	1507-0470-001
R202	100K		C203	10mf, 85°C, 10V (Electrolytic)	1513-0100-001
R203	10K		C204	.1mf, 20%, 12V (Disc.)	1502-0104-005
R204	Trimmer, 10K	4751-0103-001	C205	25mf, 85°C, 10V (Electrolytic)	1513-0250-001
R205	3.9K		C206	.47mf, +80 -20%, 3V (Disc.)	1502-0474-001
R206	2.7K		C207	.1mf, 20%, 12V (Disc.)	1502-0104-005
R207	6.8K		C208	.0033mf, 10%, 100V (Mylar Film)	1508-0332-610
R208	68K		C209	.022mf, 10%, 100V (Mylar Film)	1508-0223-610
R209	18K		C210	.1mf, 20%, 12V (Disc.)	1502-0104-005
R210	470 ohm		C211	.47mf, +80 -20%, 3V (Disc.)	1502-0474-001
R211	10K		C212	.1mf, 20%, 12V (Disc.)	1502-0104-005
R212	39K		C213	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
R213	120K		C214	.05mf, +80 -20%, 16V (Disc.)	1502-0503-003
R214	27K		C215	10mf, 20%, 25V (Tantalum)	1515-0100-005
R215	39K		C217	4-40pf, MICA Trimmer	1517-0000-009
R216	Trimmer, 10K	4751-0103-001	C218	90-400pf, MICA Trimmer	1517-0000-008
R217	470 ohm		C219	220pf, 5%, 500V MICA (29-41 MHz)	1504-0221-505
R218	270 ohm			82pf, 5%, 500V MICA (41-50 MHz)	1504-0820-505
R219	27 ohm		C220	390pf, 5%, 500V MICA (29-32 MHz)	1504-0391-505
R220	3.2 ohm	4701-0339-042		360pf, 5%, 500V MICA (32-35 MHz)	1504-0361-505
R221	18 ohm			300pf, 5%, 500V MICA (35-38 MHz)	1504-0301-505
R222	10 ohm			250pf, 5%, 500V MICA (38-41 MHz)	1504-0251-505
R223	10 ohm			200pf, 5%, 500V MICA (41-44 MHz)	1504-0201-505
R224	22 ohm			180pf, 5%, 500V MICA (44-47 MHz)	1504-0181-505
R225	100 ohm			150pf, 5%, 500V MICA (47-50 MHz)	1504-0151-505
R226	47 ohm		C221	360pf, 5%, 50V MICA (29-32 MHz)	1506-0361-550
R227	270 ohm			270pf, 5%, 50V MICA (32-35 MHz)	1506-0271-550
R228	470 ohm			250pf, 5%, 50V MICA (35-38 MHz)	1506-0251-550
R229	3.9K			200pf, 5%, 50V MICA (38-41 MHz)	1506-0201-550
R230	10 ohm			180pf, 5%, 50V MICA (41-44 MHz)	1506-0181-550
R231	100 ohm			150pf, 5%, 50V MICA (44-47 MHz)	1506-0151-550
R232	100 ohm			120pf, 5%, 50V MICA (47-50 MHz)	1506-0121-550
R233	10 ohm		C222	120pf, 5%, 50V MICA (29-32 MHz)	1506-0121-550
R234	10K			100pf, 5%, 50V MICA (32-35 MHz)	1506-0101-550
R235	82K			82pf, 5%, 50V MICA (35-38 MHz)	1506-0820-550
R236	4.7K			75pf, 5%, 50V MICA (38-41 MHz)	1506-0750-550
R237	100 ohm			56pf, 5%, 50V MICA (41-47 MHz)	1506-0560-550
R238	150 ohm			47pf, 5%, 50V MICA (47-50 MHz)	1506-0470-550
R239	27K		C223	100pf, 5%, 50V MICA (29-32 MHz)	1506-0101-550
R240	2.7K			82pf, 5%, 50V MICA (32-35 MHz)	1506-0820-550
R241	100 ohm, 1W, 10%	4701-0101-042		68pf, 5%, 50V MICA (35-38 MHz)	1506-0680-550
R242	68K			56pf, 5%, 50V MICA (38-41 MHz)	1506-0560-550
R243	100K			47pf, 5%, 50V MICA (41-47 MHz)	1506-0470-550
R244	100K			36pf, 5%, 50V MICA (47-50 MHz)	1506-0360-550
R245	120 ohm		C224	.01, +80 -20%, 16V (Disc.)	1502-0103-003
R246	180 ohm		C225	220pf, 5%, 50V MICA (29-35 MHz)	1506-0221-550
R247	47K			150pf, 5%, 50V MICA (35-41 MHz)	1506-0151-550
R248	27K			100pf, 5%, 50V MICA (41-44 MHz)	1506-0101-550
R250	150 ohm			82pf, 5%, 50V MICA (44-50 MHz)	1506-0820-550

Item No.	Description	Part No.
CAPACITORS		
C226	470pf, 5%, 50V MICA (29-35 MHz)	1506-0471-550
	360pf, 5%, 50V MICA (35-50 MHz)	1506-0361-550
C227	150pf, 5%, 50V MICA (29-35 MHz)	1506-0151-550
	100pf, 5%, 50V MICA (35-41 MHz)	1506-0101-550
	82pf, 5%, 50V MICA (41-44 MHz)	1506-0820-550
	75pf, 5%, 50V MICA (44-50 MHz)	1506-0750-550
C228	.01, +80 -20%, 16V (Disc.)	1502-0130-003
C229	360pf, 5%, 50V MICA (29-32 MHz)	1506-0361-550
	300pf, 5%, 50V MICA (32-35 MHz)	1506-0301-550
	270pf, 5%, 50V MICA (35-38 MHz)	1506-0271-550
	250pf, 5%, 50V MICA (38-41 MHz)	1506-0251-550
	220pf, 5%, 50V MICA (41-44 MHz)	1506-0221-550
	180pf, 5%, 50V MICA (44-50 MHz)	1506-0181-550
C230	1000pf, 5%, 50V MICA (29-41 MHz)	1507-0102-004
	470pf, 5%, 50V MICA (41-50 MHz)	1506-0471-550
C231	.005mf, +80 -20%, 500V Z5U (Disc.)	1503-0502-002
C232	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C233	300pf, 5%, 50V MICA (29-32 MHz)	1506-0301-550
	220pf, 5%, 50V MICA (32-38 MHz)	1506-0221-550
	200pf, 5%, 50V MICA (38-41 MHz)	1506-0201-550
	150pf, 5%, 50V MICA (41-44 MHz)	1506-0151-550
	120pf, 5%, 50V MICA (44-50 MHz)	1506-0121-550
C235	680pf, 5%, 50V MICA (29-32 MHz)	1506-0681-550
	560pf, 5%, 50V MICA (32-38 MHz)	1506-0561-550
	390pf, 5%, 50V MICA (38-44 MHz)	1506-0391-550
	220pf, 5%, 50V MICA (44-50 MHz)	1506-0221-550
C236	100pf, 5%, 50V (Mica)	1507-0102-004
C237	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C238	390pf, 5%, 50V MICA (29-32 MHz)	1506-0391-550
	360pf, 5%, 50V MICA (32-38 MHz)	1506-0361-550
	270pf, 5%, 50V MICA (38-44 MHz)	1506-0271-550
	180pf, 5%, 50V MICA (44-50 MHz)	1506-0181-550
C239	.1mf, 20%, 12V (Disc.)	1502-0104-005
C240	27pf, 10%, 500V, NPO (Disc.)	1500-0270-605
C241	5pf, 10%, 500V NPO (Disc.)	1500-0050-905
C242	.1mf, 20%, 12V (Disc.)	1502-0104-005
C243	150pf, 5%, 50V (Mica)	1506-0151-550
C244	Same as C243	
C246	2-18pf, Trimmer	1517-0000-001
C247	36pf, 5%, 50V, NPO (Disc)	1500-0360-550
*C248	Same as C246	
*C249	Same as C247	
*C250	Same as C246	
*C251	Same as C247	
*C252	Same as C246	
*C253	Same as C247	
C254	4-40pf, MICA Trimmer	1517-0000-009
C255	47pf, 5%, 500V (Mica)	1504-0470-505
C269	820pf, 5%, 500V MICA (29-38 MHz)	1504-0821-505
	470pf, 5%, 500V MICA (38-50 MHz)	1504-0471-505
C270	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C271	390pf, 5%, 50V (Mica)	1506-0391-550
C272	.0047mf, 10%, 100V (Mylar Film)	1508-0472-610

*Used on BTL-304 ONLY

Item No.	Description	Part No.
COILS		
L201	Coil, Final Output	1801-3208-700
L202	Coil, Antenna Output (29-41 MYz)	1801-3208-600
	Coil, Antenna Output (41-50 MHz)	1801-1274-200
L203	Coil, RF Choke	1803-3189-800
L204	Choke Bead Coil	1803-1245-900
L206	Coil, Modulator (29-41 MHz)	1800-3189-200
	Coil, Modulator (41-50 MHz)	1800-3208-300
L208	Ferrite Bead	2502-0000-001
L209	Same as L208	
L210	Same as L208	
L211	Same as L208	
L212	Same as L208	
T301	Transformer, SWR Bridge	1800-3190-100
T302	Transformer, Driver (Violet)	1800-3189-701
T303	Transformer (Blue)	1800-3189-601
T304	Transformer (Green)	1800-3189-501
T305	Transformer (Yellow)	1800-3189-401
T306	Transformer (Orange)	1800-3189-301

TRANSISTORS

Q201	Junct. FET	4811-0000-030
Q202	Silicon NPN	4801-0000-010
Q203	Same as Q202	
Q204	Silicon, RF Power NPN	4804-3169-503
Q205	Silicon, RF Power NPN	4804-3169-604
Q206	Silicon NPN	4804-0000-015
Q207	Silicon NPN (BT)	4801-0000-003
Q208	Silicon NPN	4801-0000-010
Q209	Silicon NPN (BT)	4801-0000-003
Q210	Silicon NPN	4801-0000-005
Q211	Silicon NPN (BT)	4801-0000-003
Q212	Same as Q211	
NOTE:	BT=Blue Top	

INTEGRATED CIRCUITS

IC201	IC, Divider	3130-3157-607
	Shield, I.C.	2508-1265-900

DIODES

CR201	Diode Silicon	4805-1241-200
CR202	Diode Silicon	4805-1241-200
CR203	Diode Silicon	4805-1241-200
CR204	Diode Varicap MY2209	4809-0000-001
CR205	Diode Varicap MY2209	4809-0000-001
CR206	Diode Zener 8.2V 1W 47384	4808-0000-009

5-3 LED DISPLAY BOARD (BTL-301) 302-057

Item No.	Description	Part No.
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RESISTORS

All Resistors are $\frac{1}{4}W$, 10%, unless otherwise noted.

R301 680 ohm
R302 470 ohm

DIODES

LD301 LED (Red) 4810-0000-001
LD302 Same as LD301

5-4 LED DISPLAY BOARD (BTL-304) 302-057

Item No.	Description	Part No.
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RESISTORS

All Resistors are $\frac{1}{4}W$, 10%, unless otherwise noted.

R301 680 ohm
R302 470 ohm

DIODES

LD301 LED (Red) 4810-0000-001
LD302 Same as LD301
LD 303 Same as LD301
LD304 Same as LD301
LD305 Same as LD301

5-5 CHASSIS ASSEMBLY

Item No.	Description	Part No.
ELECTRICAL COMPONENTS		
R1	Res Var. 5K/SW	4750-1230-305
R2	Res Var. 7.5K	4750-1230-306
C1	15pf, 10% NPO (Disc.)	1501-0150-001
C2	.05mf, +80 -20%, 25V (Disc.)	1501-0503-003
RY-1	Relay, Transmit-Receive, 12VDC	4500-0000-002
SPK-1	Speaker, 3.2 ohm, 4 inch square	
	(Assembly with Mounting Bracket)	301-934
Y100	Crystals, Receive (Specify Frequency)	302-032
		2316-0000-000
Y200	Crystals, Transmit (Specify Frequency)	302-075
		23 17-0000-000
SW1,SW2	Switch, Push, Interlocking	5112-6037-302
J1	Connector, Antenna	2105-0000-020
J2	Connector, Chassis - 4 cond. Microphone	2105-0000-021
	Assy. Chassis Mic. Connector & Bracket	102-628
P2	Connector, Cable - 4 cond. Microphone	2104-0000-001
P1	Connector, Chassis, Power	2104-0000-004
S1	Connector, Cable, Power	2108-1272-901
F1	Fuse, 10 Amp., 3 AG	5106-0000-007
	Microphone, Ceramic (No Connector)	1300-5080-902
	Microphone Assy. (Complete)	600-337-6
	DC Power Cord Assy.	102-521-3
	Cable, Shielded, Audio	Jefflex
	Cable, Coaxial 50 ohm Teflon	RG-188/U

MECHANICAL COMPONENTS

Faceplate (BTL-301)	2403-3206-300
Faceplate (BTL-304)	2403-3206-500
Front Panel (Bezel)	1405-6034-301
Knob, Volume & Squelch	2402-3178-301
Socket Pins, Crystal	2830-0000-004
Heat Sink, Driver Transistor	5400-0000-002
Heat Sink, Final Transistor	5400-3192-100
Bracket, Relay Mounting	1400-1246-600
Terminal Board, 3 Lug (Rear Panel)	2103-3007-907
Foot, Rubber	1402-0000-001
Cabinet/Wrap Assembly	1408-6035-202
Bracket, Mobile Mounting	1400-3192-400
Bracket, Security	1400-1241-500
Bracket, Mic. Conn.	1400-1258-200

SECTION 6 SERVICE MANUAL ADDENDUM

The following modifications now exist in the BTL-301 and BTL-304 VHF FM transceivers. The revisions include the addition of a Power Regulator Board, 302-342 and the modification of the existing Transmitter Board 500-996. Effective June, 1974.

ADDENDUM CONTENTS

- 6-1 Text revisions
- 6-2 Component revisions to Transmitter Board 500-996
- 6-3 Transmitter Block Diagram
- 6-4 Transmitter Board Parts Placement Diagram
- 6-5 Transmitter Board Parts Overlay Diagram
- 6-6 Power Regulator Board Parts Placement Diagram
- 6-7 Power Regulator Board Parts Overlay Diagram
- 6-8 Power Regulator Board Parts List
- 6-9 Schematic with Voltages (BTL-301)
- 6-10 Schematic with Voltages (BTL-304)

6-1 TEXT REVISIONS

Section 1; Page 3

Specifications are the same as described in Section 1 except for the following change:

Silicon Transistors (Total)..... 26

Section 2; Page 4

Power output section description is the same as described in Section 2 except for the following changes:

c. SWR Bridge

In the event of a load mismatch at the antenna terminals, the SWR Bridge consisting of T201, R218 and CR203 will detect the mismatch and send a signal to the Driver Limiter. The Driver Limiter (Q208, Q401 and Q402) will then bias Q205 in an off condition, preventing possible damage to the power amplifier (Q204). Load mismatch is detected by comparing the phases of output voltage and current to determine if standing waves exist on the line.

Transmitter tuning procedure is the same as described in Section 3 except for the following changes:

3-7-10 T203: Connect the VTVM probe to the junction of T202 and C270 and the common lead to ground. Adjust the secondary core and then the primary core for a dip in the meter reading. Normal voltage should be 13.0 V.

3-7-11 T202: Adjust both primary and secondary for maximum RF power output as indicated on wattmeter.

6-2 COMPONENT REVISIONS TO TRANSMITTER BOARD 500-996

See 6-4 and 6-5 for exact locations of component added.

Components Added:

C273, .01 μ f, +80-20%, 50V, YM (Disc.) 1503-0103-007 - Copper Side
C274, .01 μ f, +80-20%, 50V, YM (Disc.) 1503-0103-007 - Copper Side
C275, .01 μ f, +80-20%, 50V, YM (Disc.) 1503-0103-007 - Copper Side
C276, .01 μ f, +80-20%, 50V, YM (Disc.) 1503-0103-007 - Component Side
J1..... Copper Side
J2..... Component Side
J3..... Component Side

Components Removed:

R220 3.2 Ohms \pm 10% 1/4W
R226 47 Ohms \pm 10% 1/4W
R232 100 Ohms \pm 10% 1/4W
R333 10 Ohms \pm 10% 1/4W
R234 10K \pm 10% 1/4W
C234 NOT USED
Q210 Silicon NPN 4801-0000-005

Board Jumpers (TX Bd. To Pwr. Reg. Bd.)

Point A Yellow Wire
Point B Orange Wire
Point C Black Wire
Point D Green Wire

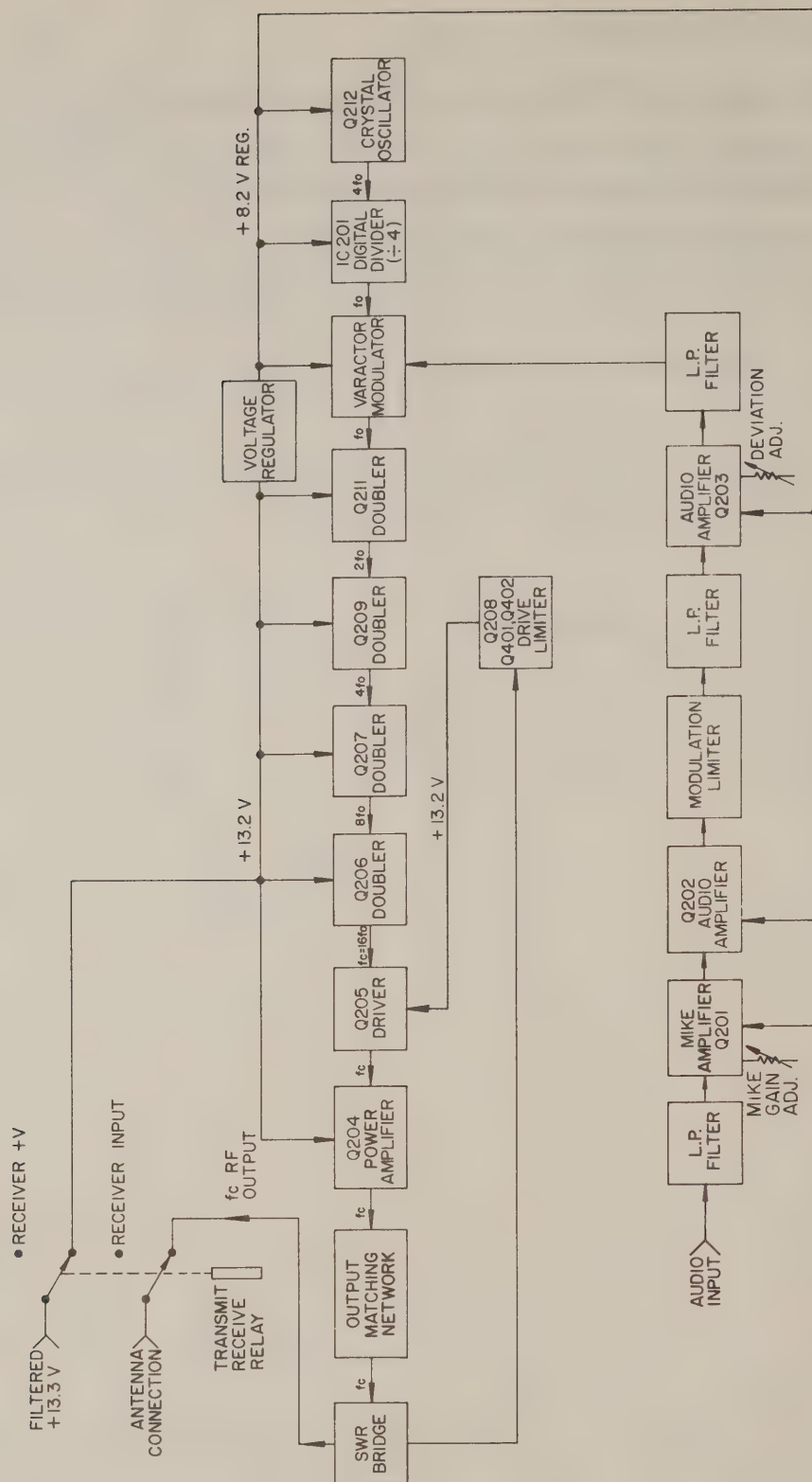
CAPACITANCE VALUE MODIFICATIONS

At 35 to 41 MHz, C219 should have an 82 PF value instead of a 220 PF value.

At 35 to 41 MHz, C269 should have a 1000 PF value instead of an 820 PF value at 35 to 38 MHz and a 470 PF value at 38-41 MHz.

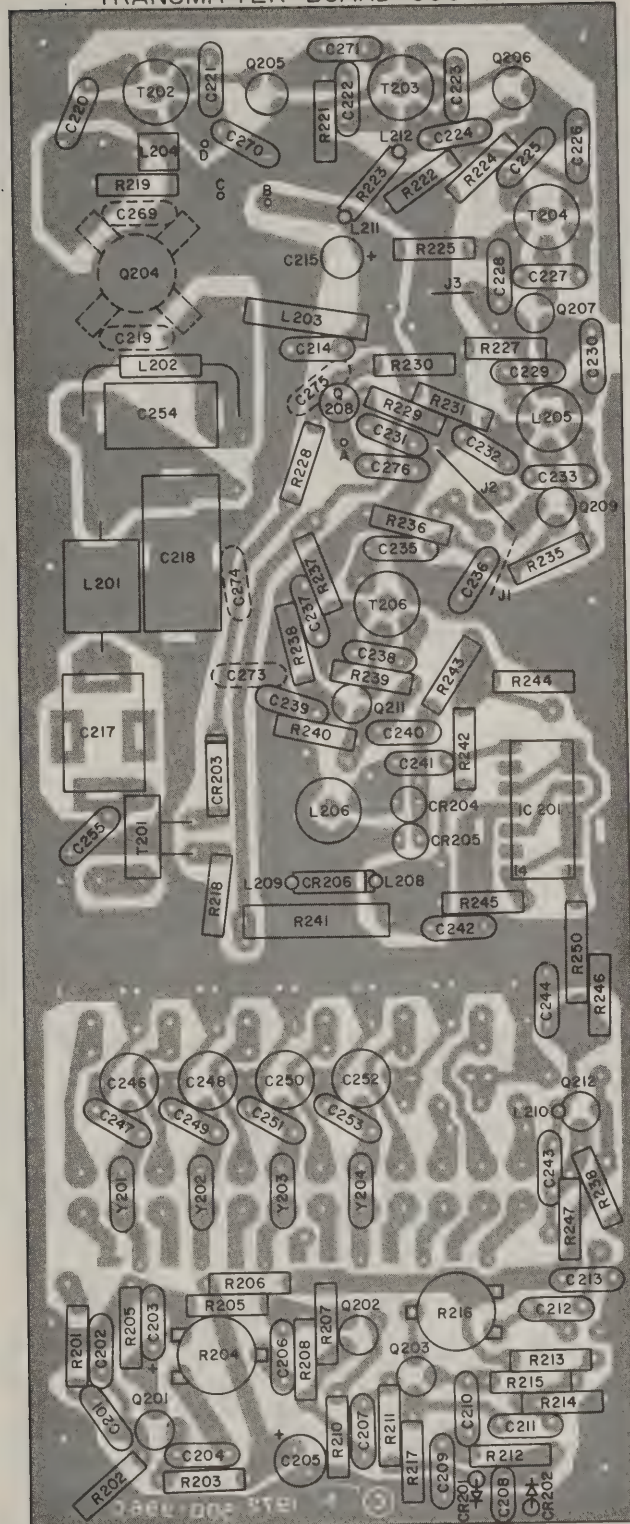
At 41 to 50 MHz, C269 is no longer used.

See Transmitter Component Value Table on 6-9 and 6-10.



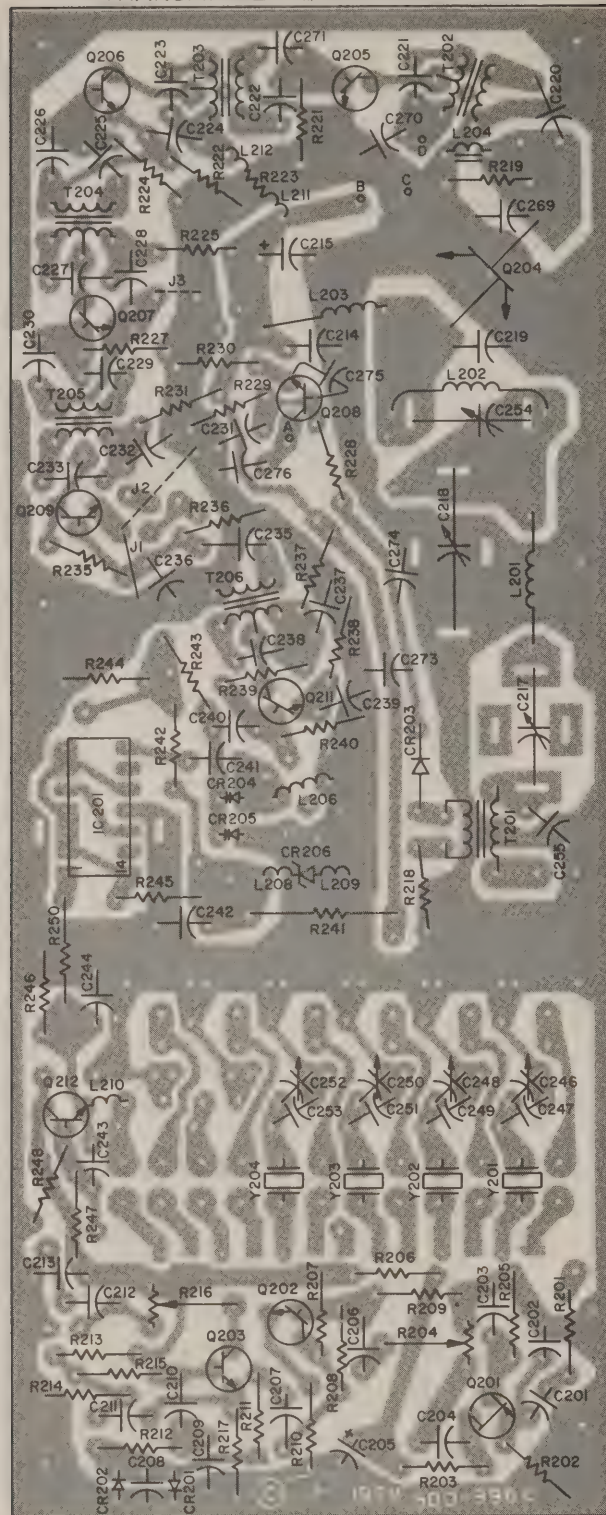
6-3 TRANSMITTER BLOCK DIAGRAM

TRANSMITTER BOARD 500-996

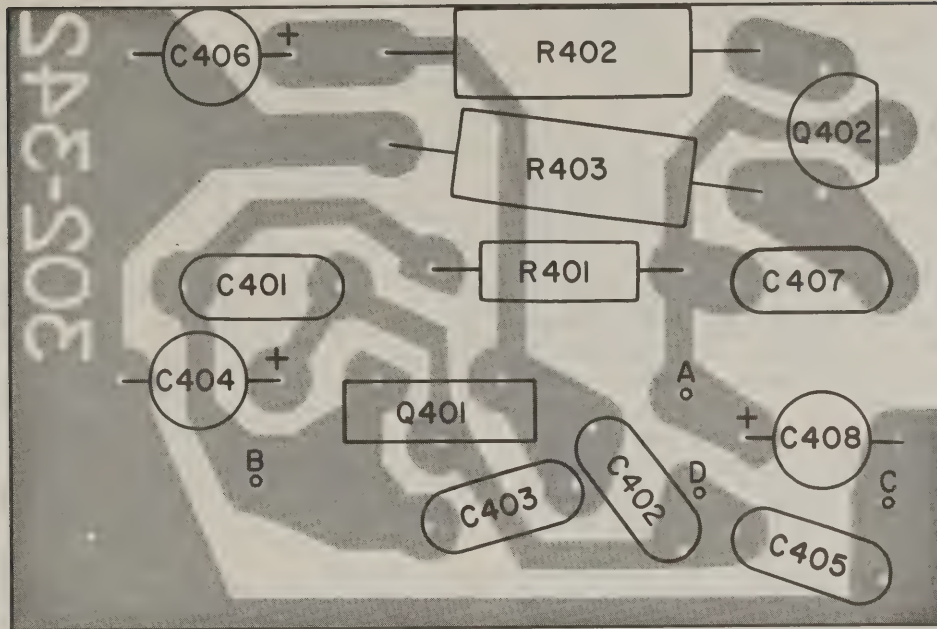


6-4 TRANSMITTER BOARD PARTS PLACEMENT DIAGRAM

TRANSMITTER BOARD 500-996

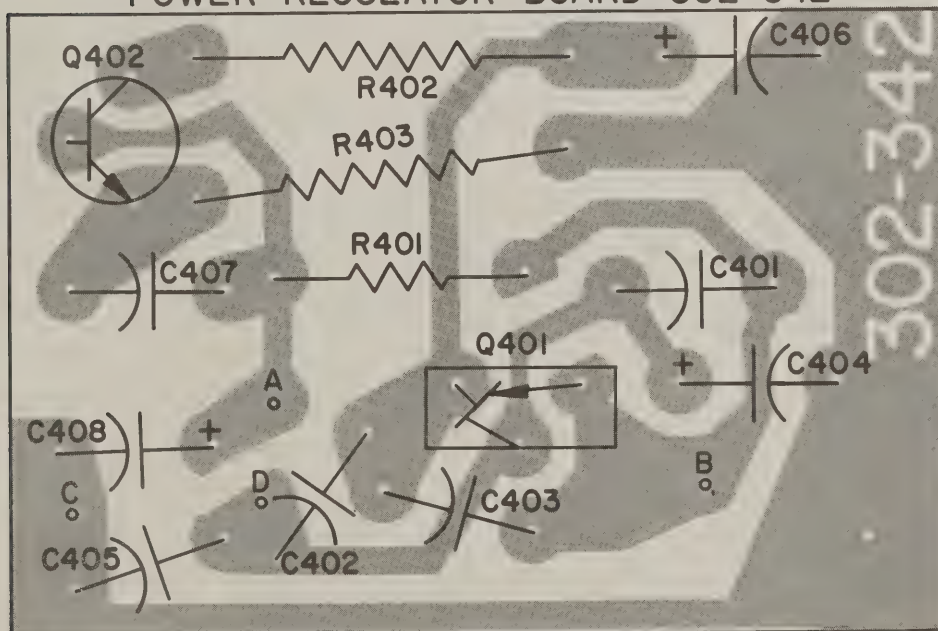


POWER REGULATOR BOARD 302-342



6-6 POWER REGULATOR BOARD PARTS PLACEMENT DIAGRAM

POWER REGULATOR BOARD 302-342



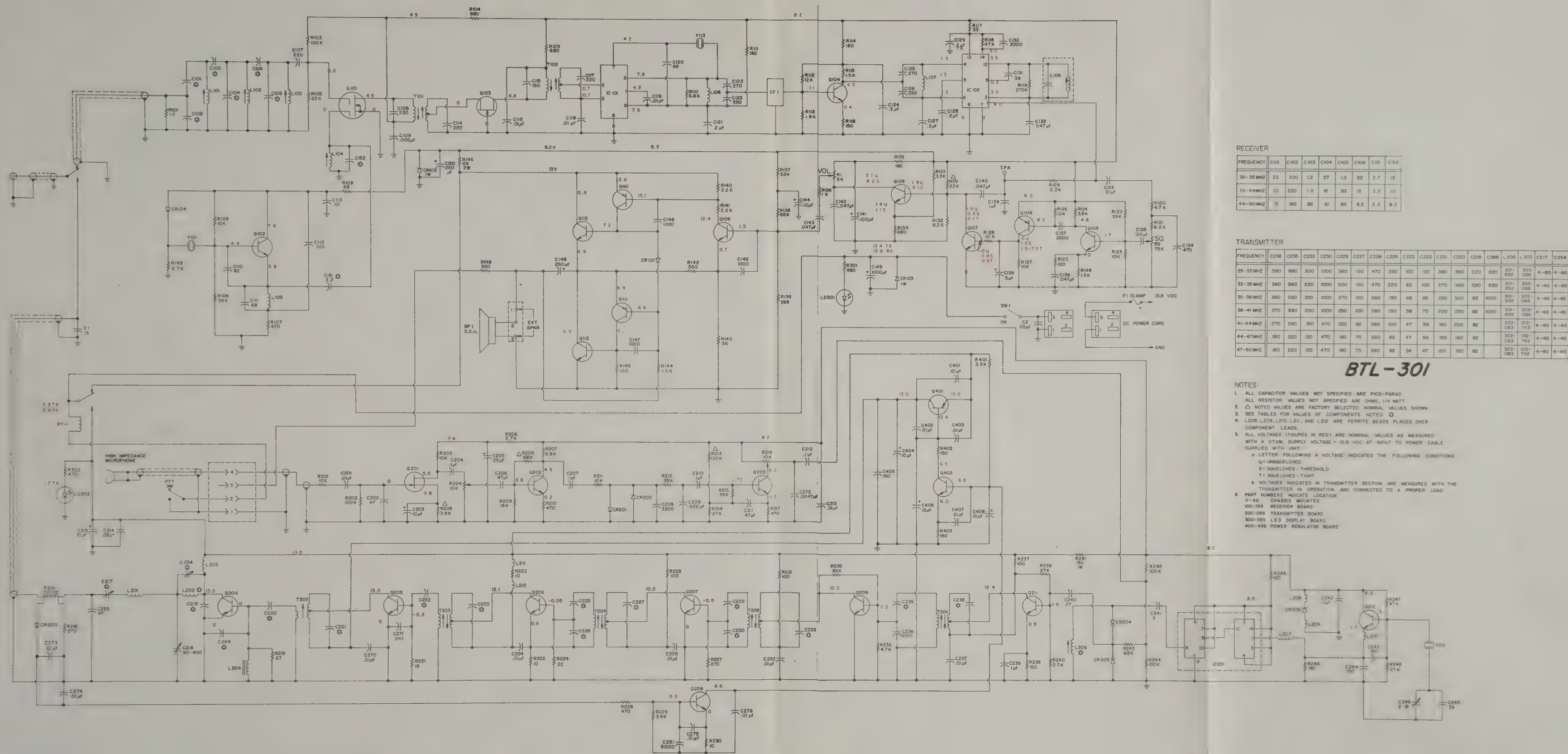
6-7 POWER REGULATOR BOARD PARTS OVERLAY DIAGRAM

6-8 POWER REGULATOR BOARD 302-342 PARTS LIST

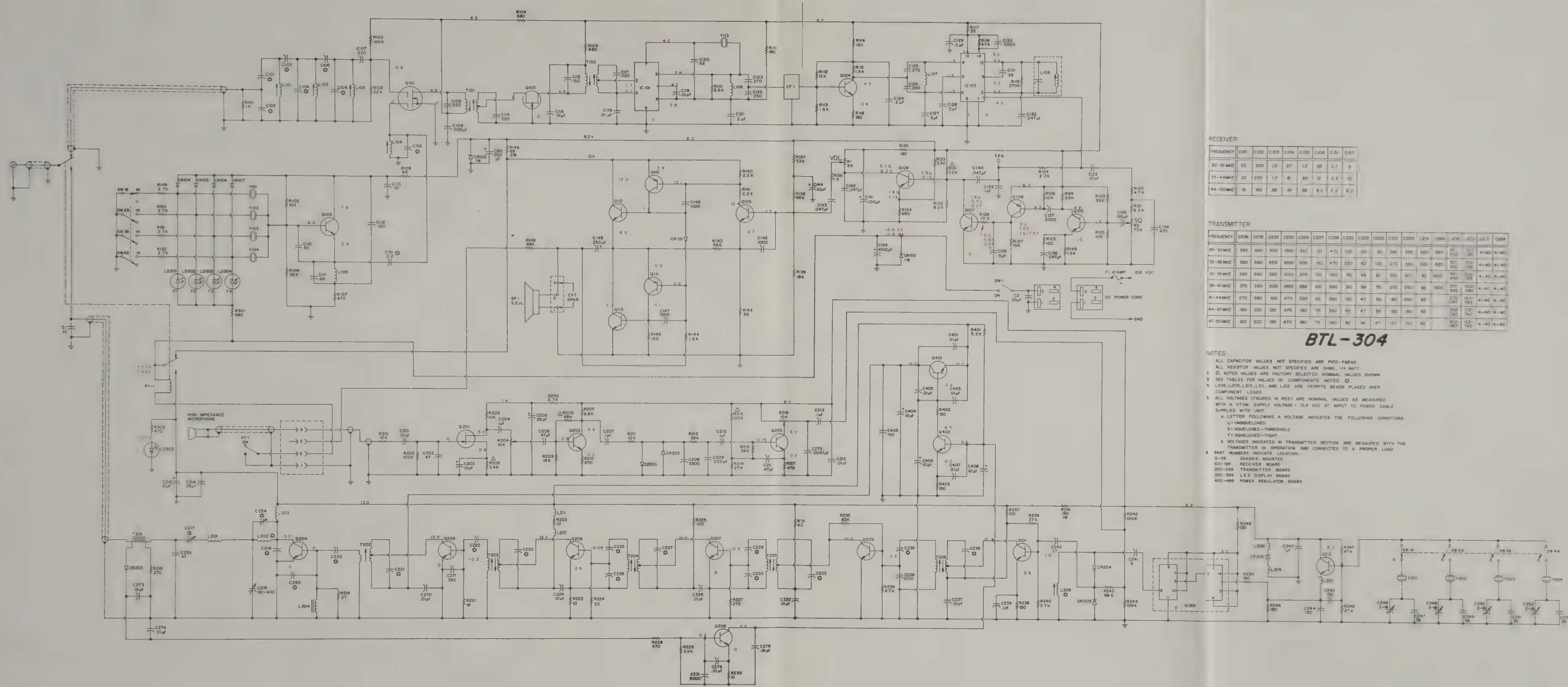
Item No.	Description	Part No.
RESISTORS		
R401	3.3K 10% ¼W	4701-0332-042
R402	150 ohms 10% ½W	4701-0151-044
R403	150 ohms 10% ½W	4701-0151-044
CAPACITORS		
C401	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C402	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C403	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C404	10 uf 20% 25V TANT	1515-0100-005
C405	150 pf 20% 50V Z5F	1523-0151-002
C406	10 uf 20% 25V TANT	1515-0100-005
C407	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C408	10 uf 20% 25V TANT	1515-0100-005
TRANSISTORS		
Q401	Silicon SPS 952	4801-0000-010
Q402	Silicon Power PNP SJE 1608	4802-0000-003

6-8 POWER REGULATOR BOARD 302-342 PARTS LIST

Item No.	Description	Part No.
RESISTORS		
R401	3.3K 10% ¼W	4701-0332-042
R402	150 ohms 10% ½W	4701-0151-044
R403	150 ohms 10% ½W	4701-0151-044
CAPACITORS		
C401	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C402	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C403	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C404	10 uf 20% 25V TANT	1515-0100-005
C405	150 pf 20% 50V Z5F	1523-0151-002
C406	10 uf 20% 25V TANT	1515-0100-005
C407	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C408	10 uf 20% 25V TANT	1515-0100-005
TRANSISTORS		
Q401	Silicon SPS 952	4801-0000-010
Q402	Silicon Power PNP SJE 1608	4802-0000-003



6-9 SCHEMATIC WITH VOLTAGES (BTL-301)



RECEIVER

FREQUENCY	C101	C102	C103	C104	C105	C106	C107	C108
30-35 MHz	33	300	1.2	27	1.2	100	2.7	5
35-44 MHz	22	220	1.0	10	82	12	2.2	10
44-50 MHz	15	180	.82	10	82	8.2	2.2	5

TRANSMITTER																			
FREQUENCY	C336	C338	C333	C230	C229	C227	C226	C228	C223	C222	C221	C219	C269	470	475	476	477	478	479
29-32 MHz	390	680	300	1000	360	50	475	220	100	26	360	390	220	680	50	100	100	100	100
32-35 MHz	360	580	220	1000	300	150	470	220	100	62	100	270	360	220	1000	50	100	100	100
35-38 MHz	360	580	220	1000	270	150	360	50	68	87	250	300	82	1000	50	100	100	100	100
38-41 MHz	270	390	200	1000	220	150	360	50	56	75	200	250	82	1000	50	100	100	100	100
41-44 MHz	270	390	150	470	220	62	360	100	47	56	180	200	62	1000	50	100	100	100	100
44-47 MHz	180	220	120	470	180	75	360	82	47	56	150	180	82	1000	50	100	100	100	100
47-50 MHz	180	220	120	470	180	75	360	82	47	56	150	180	82	1000	50	100	100	100	100

- BTL-304**
- NOTES
- ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD.
 - ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT.
 - Δ NOTED VALUES ARE FACTORY SELECTED NOMINAL VALUES SHOWN.
 - SEE TABLES FOR VALUES OF COMPONENTS NOTED Δ.
 - L208, L209, L210, L211, AND L212 ARE FERRITE BEADS PLACED OVER COMPONENT LEADS.
 - ALL VOLTAGES (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED WITH A VTVM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE SUPPLIED WITH UNIT.
 - LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
 U = UNSQUELCHED
 S = SQUELCHED - THRESHOLD
 T = SQUELCHED - TIGHT
 - VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD.
 - PART NUMBERS INDICATE LOCATION:
 0-99 CHASSIS MOUNTED
 100-199 RECEIVER BOARD
 200-299 TRANSMITTER BOARD
 300-399 LED DISPLAY BOARD
 400-499 POWER REGULATOR BOARD

6-10 SCHEMATIC WITH VOLTAGES (BTL-304)

SECTION 7 SERVICE MANUAL ADDENDUM

The following modifications now exist in the (BTL-301 and BTL-304) VHF FM Transceivers. The revisions pertain to the Transmitter Board 500-996. Effective October, 1974.

ADDENDUM CONTENTS

- 7-1 Text revisions
- 7-2 Component revision to Transmitter Board 500-996
- 7-3 Transmitter Board Parts Placement Diagram
- 7-4 Transmitter Board Parts Overlay Diagram
- 7-5 Schematic with Voltages (BTL-301)
- 7-6 Schematic with Voltages (BTL-304)

7-1 TEXT REVISIONS

SECTION 3

Transmitter tuning procedure is the same as described in Section 3 except for the following changes:

Page 5

3-7-6 Modulator Alignment

- a. Connect the common lead of the VTVM to the A+ buss in the transmitter (Junction of R237, R231, etc.).
- b. Connect the probe of the VTVM to the Junction of R237 and T206, (TP 6).
- c. Tune the core of L206 for peak on the VTVM (maximum voltage drop across R237). Normal voltage is -0.8 volts.

3-7-7 T206: The common lead of the VTVM is left connected to the A+ buss during the remainder of the alignment. Before proceeding, back all of the bottom cores of transformers T202 through T206 until the cores are flush with the bottom of the P.C. Board. Connect the VTVM probe to the Junction of R231 and T205 (TP 7). Tune the primary (top core) of T206 for a peak reading on the VTVM (max. voltage drop across R231), and then adjust the bottom core of T206 for a peak reading. Normal voltage is -1.8 volts. In adjusting T203 through T206, the secondary (top core) is first peaked with the primary (bottom core) backed out of its winding, and then the primary is tuned. It is then permissible to peak both slugs.

- 3-7-8 T205: Connect the VTVM probe to the Junction of R225 and T204 (TP 8). Adjust the secondary core and then the primary core for a peak reading on the VTVM as in 5a. above. Normal voltage is -3.5 volts.
- 3-7-9 T204: Connect the VTVM probe to the Junction of R223 and T203 (TP 9). Adjust the secondary core and then the primary core for a peak reading as in 5a. above. Return to T205 and repeak the secondary and primary for peak reading at (TP 9). Repeak T204 for maximum reading at (TP 9). Repeat the tuning of T205 and T204 until a maximum peak is obtained at (TP 9). Normal voltage is -1.2 volts.

Steps 3-7-10 and 3-7-11 appear in this Section and Section 6-1. Replace them both with the following steps:

- 3-7-10 T203: Connect the VTVM probe to the Junction of R220 and T302 (TP 10). Adjust the secondary and primary cores of T203 as in 5a. above. Normal voltage is -0.1 volts at (TP 10).

7-2 TRANSMITTER BOARD 500-996

Item No.	Description	Part No.	Item No.	Description	Part No.
RESISTORS			CAPACITORS		
All Resistors are $\pm 10\%$, $\frac{1}{4}W$, unless otherwise noted.			C201	.01mf, 10%, 100V (Mylar Film)	1508-0103-610
R201	10K		C202	47pf, 5%, 50V (Mica)	1507-0470-001
R202	100K		C203	10mf, 85°C, 10V (Electrolytic)	1513-0100-001
R203	10K		C204	.1mf, 20%, 12V (Disc.)	1502-0104-005
R204	Trimmer, 10K	4751-0103-001	C205	25mf, 85°C, 10V (Electrolytic)	1513-0250-001
R205	3.9K		C206	.47mf, +80 -20%, 3V (Disc.)	1502-0474-001
R206	2.7K		C207	.1mf, 20%, 12V (Disc.)	1502-0104-005
R207	6.8K		C208	.0033mf, 10%, 100V (Mylar Film)	1508-0332-610
R208	68K		C209	.022mf, 10%, 100V (Mylar Film)	1508-0223-610
R209	18K		C210	.1mf, 20%, 12V (Disc.)	1502-0104-005
R210	470 ohm		C211	.47mf, +80 -20%, 3V (Disc.)	1502-0474-001
R211	10K		C212	.1mf, 20%, 12V (Disc.)	1502-0104-005
R212	39K		C213	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
R213	120K		C214	.05mf, +80 -20%, 16V (Disc.)	1502-0503-003
R214	27K		C215	10mf, 20%, 25V (Tantalum)	1515-0100-005
R215	39K		C217	4-40pf MICA Trimmer (38-50 MHz)	1517-0000-009
R216	Trimmer, 10K	4751-0103-001		4-60pf MICA Trimmer (29-38 MHz)	1517-0000-005
R217	470 ohm		C218	90-400pf, MICA Trimmer	1517-0000-008
R218	330 ohm, 5%		C219	470pf, 5%, 500v, MICA (29-32 MHz)	1504-0471-505
R219	10 ohm (29-47 MHz)			390pf, 5%, 500v, MICA (32-35 MHz)	1504-0391-505
	15 ohm (47-50 MHz)			300pf, 5%, 500v, MICA (35-38 MHz)	1504-0301-505
R220	3.2 ohm	4701-0339-042		270pf, 5%, 500v, MICA (38-41 MHz)	1504-0271-505
R221	18 ohm			220pf, 5%, 500v, MICA (41-44 MHz)	1504-0221-505
R222	10 ohm			180pf, 5%, 500v, MICA (44-47 MHz)	1504-0181-505
R223	10 ohm		C220	150pf, 5%, 500v, MICA (47-50 MHz)	1504-0151-505
R224	22 ohm			390pf, 5%, 500V MICA (29-32 MHz)	1504-0391-505
R225	100 ohm			360pf, 5%, 500V MICA (32-35 MHz)	1504-0361-505
R226	47 ohm			300pf, 5%, 500V MICA (35-38 MHz)	1504-0301-505
R227	270 ohm			250pf, 5%, 500V MICA (38-41 MHz)	1504-0251-505
R228	470 ohm (29-32 MHz)			200pf, 5%, 500V MICA (41-44 MHz)	1504-0201-505
	680 ohm (32-35 MHz)			180pf, 5%, 500V MICA (44-47 MHz)	1504-0181-505
	820 ohm (35-38 MHz)			150pf, 5%, 500V MICA (47-50 MHz)	1504-0151-505
	1.5K ohm (38-41 MHz)		C221	300pf, 5%, 50v MICA (29-32 MHz)	1506-0301-550
	1.8K ohm (41-44 MHz)			250pf, 5%, 50v MICA (32-35 MHz)	1506-0251-550
	2.2K ohm (44-47 MHz)			200pf, 5%, 50v MICA (35-38 MHz)	1506-0201-550
	2.7K ohm (47-50 MHz)			180pf, 5%, 50v MICA (38-41 MHz)	1506-0181-550
R229	1.5K			150pf, 5%, 50v MICA (41-44 MHz)	1506-0151-550
R230	10 ohm			120pf, 5%, 50v MICA (44-47 MHz)	1506-0121-550
R231	100 ohm		C222	100pf, 5%, 50v MICA (47-50 MHz)	1506-0101-550
R235	82K			120pf, 5%, 50V MICA (29-32 MHz)	1506-0121-550
R236	4.7K			100pf, 5%, 50V MICA (32-35 MHz)	1506-0101-550
R237	100 ohm			82pf, 5%, 50V MICA (35-38 MHz)	1506-0820-550
R238	150 ohm			75pf, 5%, 50V MICA (38-41 MHz)	1506-0750-550
R239	27K			56pf, 5%, 50V MICA (41-47 MHz)	1506-0560-550
R240	2.7K			47pf, 5%, 50V MICA (47-50 MHz)	1506-0470-550
R241	100 ohm, 1W, 10%	4701-0101-042	C223	100pf, 5%, 50V MICA (29-32 MHz)	1506-0101-550
R242	68K			82pf, 5%, 50v MICA (32-38 MHz)	1506-0820-550
R243	100K			56pf, 5%, 50V MICA (38-41 MHz)	1506-0560-550
R244	100K			47pf, 5%, 50V MICA (41-47 MHz)	1506-0470-550
R245	120 ohm		C224	36pf, 5%, 50V MICA (47-50 MHz)	1506-0360-550
R246	180 ohm			.01, +80 -20%, 16V (Disc.)	1502-0103-003
R247	47K		C225	220pf, 5%, 50V MICA (29-35 MHz)	1506-0221-550
R248	27K			150pf, 5%, 50V MICA (35-41 MHz)	1506-0151-550
R250	150 ohm			100pf, 5%, 50V MICA (41-44 MHz)	1506-0101-550
				82pf, 5%, 50V MICA (44-50 MHz)	1506-0820-550

Item No.	Description	Part No.
CAPACITORS		
C226	470pf, 5%, 50V MICA (29-35 MHz)	1506-0471-550
	360pf, 5%, 50V MICA (35-50 MHz)	1506-0361-550
C227	150pf, 5%, 50V MICA (29-35 MHz)	1506-0151-550
	100pf, 5%, 50V MICA (35-41 MHz)	1506-0101-550
	82pf, 5%, 50V MICA (41-44 MHz)	1506-0820-550
	75pf, 5%, 50V MICA (44-50 MHz)	1506-0750-550
C228	.01, +80 -20%, 16V (Disc.)	1502-0130-003
C229	360pf, 5%, 50V MICA (29-32 MHz)	1506-0361-550
	300pf, 5%, 50V MICA (32-35 MHz)	1506-0301-550
	270pf, 5%, 50V MICA (35-38 MHz)	1506-0271-550
	250pf, 5%, 50V MICA (38-41 MHz)	1506-0251-550
	220pf, 5%, 50V MICA (41-44 MHz)	1506-0221-550
	180pf, 5%, 50V MICA (44-50 MHz)	1506-0181-550
C230	1000pf, 5%, 50V MICA (29-41 MHz)	1507-0102-004
	470pf, 5%, 50V MICA (41-50 MHz)	1506-0471-550
C231	.005mf, +80 -20%, 500V Z5U (Disc.)	1503-0502-002
C232	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C233	300pf, 5%, 50V MICA (29-32 MHz)	1506-0301-550
	220pf, 5%, 50V MICA (32-38 MHz)	1506-0221-550
	200pf, 5%, 50V MICA (38-41 MHz)	1506-0201-550
	150pf, 5%, 50V MICA (41-44 MHz)	1506-0151-550
	120pf, 5%, 50V MICA (44-50 MHz)	1506-0121-550
C235	680pf, 5%, 50V MICA (29-32 MHz)	1506-0681-550
	560pf, 5%, 50V MICA (32-38 MHz)	1506-0561-550
	390pf, 5%, 50V MICA (38-44 MHz)	1506-0391-550
	220pf, 5%, 50V MICA (44-50 MHz)	1506-0221-550
C236	100pf, 5%, 50V (Mica)	1507-0102-004
C237	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C238	390pf, 5%, 50V MICA (29-32 MHz)	1506-0391-550
	360pf, 5%, 50V MICA (32-38 MHz)	1506-0361-550
	270pf, 5%, 50V MICA (38-44 MHz)	1506-0271-550
	180pf, 5%, 50V MICA (44-50 MHz)	1506-0181-550
C239	.1mf, 20%, 12V (Disc.)	1502-0104-005
C240	27pf, 10%, 500V, NPO (Disc.)	1500-0270-605
C241	5pf, 10%, 500V NPO (Disc.)	1500-0050-905
C242	.1mf, 20%, 12V (Disc.)	1502-0104-005
C243	150pf, 5%, 50V (Mica)	1506-0151-550
C244	Same as C243	
C246	2-18pf, Trimmer	1517-0000-001
C247	39pf, 50v, 5% 00-580	1500-0390-550
*C248	Same as C246	
*C249	Same as C247	
*C250	Same as C246	
*C251	Same as C247	
*C252	Same as C246	
*C253	Same as C247	
C254	4-60pf MICA Trimmer (29-38 MHz)	1517-0000-005
C254	4-40pf, MICA Trimmer (38-50 MHz)	1517-0000-009
C255	47pf, 5%, 500V (Mica)	1504-0470-505
C269	300pf, 5%, 500v MICA (29-38 MHz)	1504-0301-505
	270pf, 5%, 500v MICA (38-41 MHz)	1504-0271-505
	1000pf, 5% 500v MICA (41-44MHz)	1504-0102-505
	180pf, 5%, 500v MICA (44-47 MHz)	1504-0181-505
	150pf, 5%, 500v MICA (47-50 MHz)	1504-0151-505
C270	.001mf, +80 -20%, 50v (DISC)	1503-0102-003
C271	390pf, 5%, 50v MICA (47-50 MHz)	1506-0391-550
	560pf, 5%, 50v MICA (29-47 MHz)	1506-0561-550

Item No.	Description	Part No.
C272	.0047mf, 10%, 100V (Mylar Film)	1508-0472-610
C273	.01 uf, +80-20%, 50V, YM (Disc.)	1503-0103-007
C274	.01 uf, +80-20%, 50V, YM (Disc.)	1503-0103-007
C275	.01 uf, +80-20%, 50V, YM (Disc.)	1503-0103-007
C276	.01 uf, +80-20%, 50V, YM (Disc.)	1503-0103-007
C277	200pf, 5%, 50v MICA (29-35 MHz)	1506-0201-550
	100pf, 5%, 50v MICA (35-50 MHz)	1506-0101-550

*Used on BTL-304 ONLY

COILS

L201	Coil Final Output (29-35 MHz)	1801-3240-400
	Coil Final Output (35-41 MHz)	1801-3208-700
	Coil Final Output (41-50 MHz)	1801-3219-600
L202	Coil, Antenna Output (29-41 MHz)	1801-3208-600
	Coil, Antenna Output (41-50 MHz)	1801-1274-201
L203	Coil, RF Choke	1803-3189-800
L204	Choke Bead Coil	1803-1245-900
L206	Coil, Modulator (29-41 MHz)	1800-3189-200
	Coil, Modulator (41-50 MHz)	1800-3208-300
L208	Ferrite Bead	2502-0000-001
L209	Same as L208	
L210	Same as L208	
L211	Same as L208	
L212	Same as L208	
T201	Transformer, SWR Bridge	1800-3190-100
T202	Transformer, Driver (Violet)	1800-3189-701
T203	Transformer (Blue)	1800-3189-601
T204	Transformer (Green)	1800-3189-501
T205	Transformer (Yellow)	1800-3189-401
T206	Transformer (Orange)	1800-3189-301

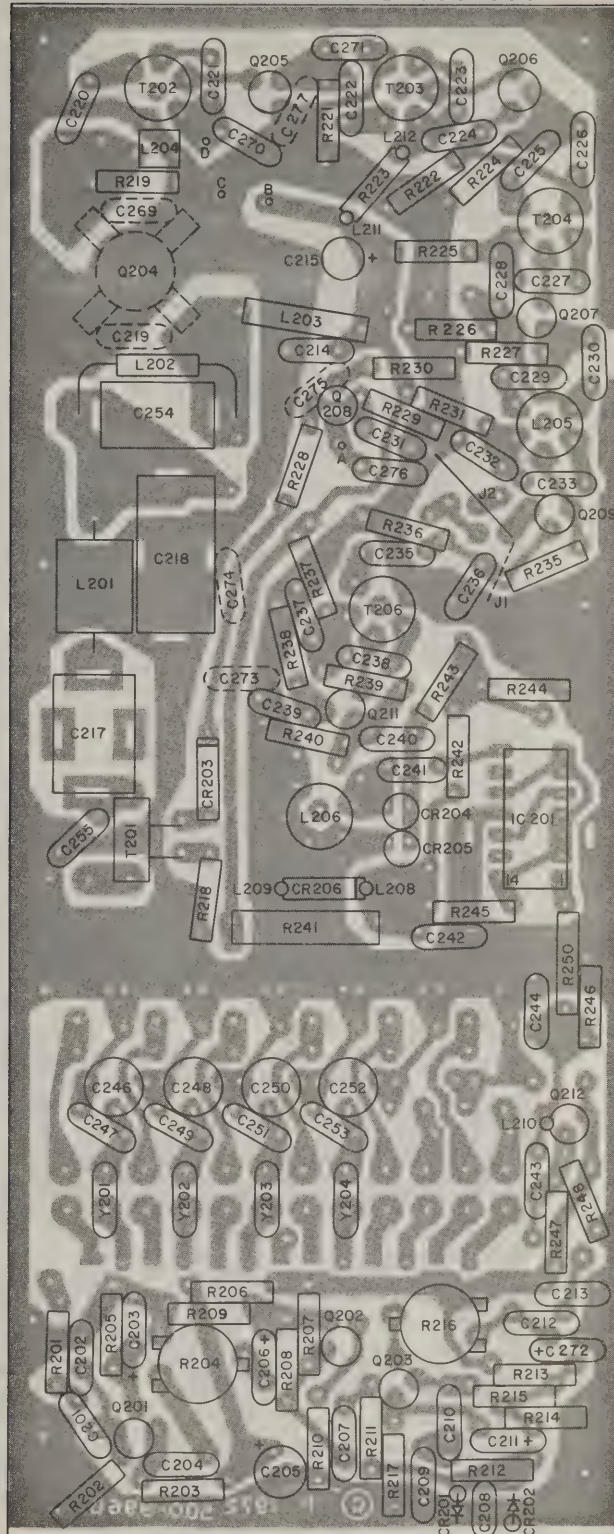
TRANSISTORS

Q201	Junct. FET	4811-0000-030
Q202	Silicon NPN	4801-0000-010
Q203	Same as Q202	
Q204	Silicon, RF Power NPN	4804-3169-503
Q205	Silicon, RF Power NPN	4804-3169-604
Q206	Silicon NPN	4804-0000-015
Q207	Silicon NPN (BT)	4801-0000-003
Q208	Silicon NPN	4801-0000-010
Q209	Silicon NPN (BT)	4801-0000-003
Q211	Silicon NPN (BT)	4801-0000-003
Q212	Same as Q211	
NOTE:	BT=Blue Top	

INTEGRATED CIRCUITS

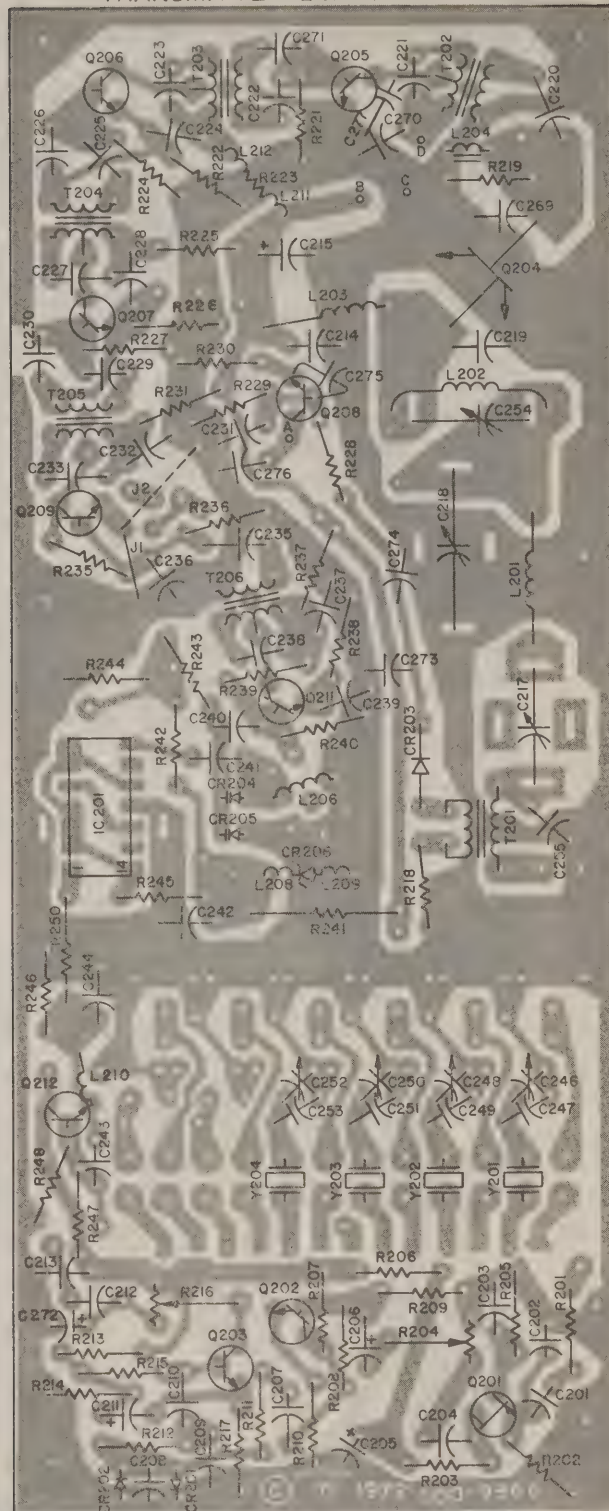
IC201	IC, Divider	3130-3157-607
	Shield, I.C.	2508-1265-900

TRANSMITTER BOARD 500-996

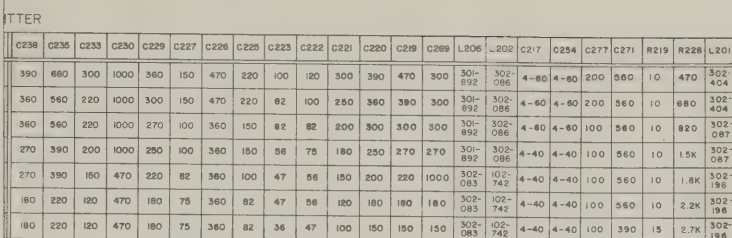
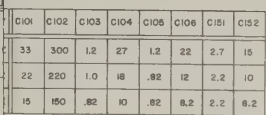


7-3 TRANSMITTER BOARD PARTS PLACEMENT DIAGRAM

TRANSMITTER BOARD 500-996



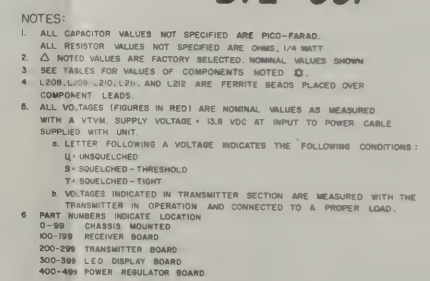
7-4 TRANSMITTER BOARD PARTS OVERLAY DIAGRAM

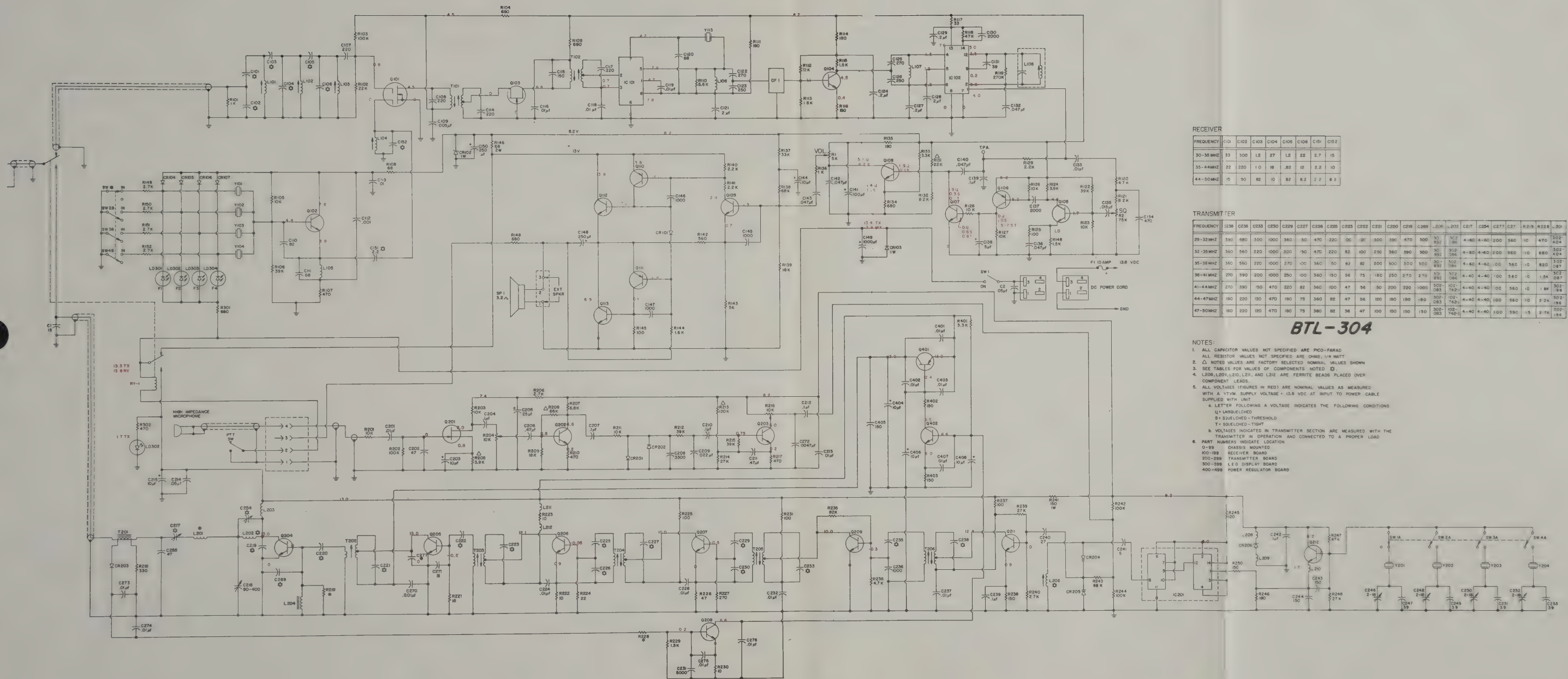


FACTOR VALUES NOT SPECIFIED ARE PICO-FARAD.
 RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT.
 DIMENSIONAL VALUES ARE FACTORY SELECTED NOMINAL VALUES SHOWN.
 DIMENSIONS FOR VALUES OF COMPONENTS NOTED *
 DIMENSIONS FOR VALUES OF COMPONENTS NOTED *
 R09, L20, L21, AND L22 ARE FERRITE BEADS PLACED OVER
 WIRE LEADS.
 DIMENSIONS (FIGURES IN RED) ARE NOMINAL VALUES AS MEASURED
 WITH VTCM. SUPPLY VOLTAGE = 13.8 VDC AT INPUT TO POWER CABLE
 WITH 100% MODULATION.
 LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
 UNQUENCHED
 SQUENCHED—THRESHOLD
 SQUENCHED—TIGHT
 DIMENSIONS INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE
 TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD.
 DIMENSIONS INDICATE LOCATION
 CHASSIS MOUNTED
 RECEIVER BOARD
 TRANSMITTER BOARD
 LED DISPLAY BOARD
 POWER REGULATOR BOARD

TRANSMITTER BOARD 500-996







RECEIVER

FREQUENCY	C101	C102	C103	C104	C105	C106	C107
30-35 MHz	33	300	12	27	12	22	2.7
35-44 MHz	22	220	10	18	.82	12	2.2
44-50 MHz	15	50	82	10	82	8.2	2.2

TRANSMITTER

FREQUENCY	C238	C239	C240	C241	C242	C243	C244	C245	C246	C247	C248	C249	C250	C251	C252	C253	C254	C255	C256	C257	C258	C259	C260	C261	C262	C263	C264	C265	C266	C267	C268	C269	C270	C271	C272	C273	C274	C275	C276	C277	C278	C279	C280	C281	C282	C283	C284	C285	C286	C287	C288	C289	C290	C291	C292	C293	C294	C295	C296	C297	C298	C299	C300	C301	C302	C303	C304	C305	C306	C307	C308	C309	C310	C311	C312	C313	C314	C315	C316	C317	C318	C319	C320	C321	C322	C323	C324	C325	C326	C327	C328	C329	C330	C331	C332	C333	C334	C335	C336	C337	C338	C339	C340	C341	C342	C343	C344	C345	C346	C347	C348	C349	C350	C351	C352	C353	C354	C355	C356	C357	C358	C359	C360	C361	C362	C363	C364	C365	C366	C367	C368	C369	C370	C371	C372	C373	C374	C375	C376	C377	C378	C379	C380	C381	C382	C383	C384	C385	C386	C387	C388	C389	C390	C391	C392	C393	C394	C395	C396	C397	C398	C399	C400	C401	C402	C403	C404	C405	C406	C407	C408	C409	C410	C411	C412	C413	C414	C415	C416	C417	C418	C419	C420	C421	C422	C423	C424	C425	C426	C427	C428	C429	C430	C431	C432	C433	C434	C435	C436	C437	C438	C439	C440	C441	C442	C443	C444	C445	C446	C447	C448	C449	C450	C451	C452	C453	C454	C455	C456	C457	C458	C459	C460	C461	C462	C463	C464	C465	C466	C467	C468	C469	C470	C471	C472	C473	C474	C475	C476	C477	C478	C479	C480	C481	C482	C483	C484	C485	C486	C487	C488	C489	C490	C491	C492	C493	C494	C495	C496	C497	C498	C499	C500	C501	C502	C503	C504	C505	C506	C507	C508	C509	C510	C511	C512	C513	C514	C515	C516	C517	C518	C519	C520	C521	C522	C523	C524	C525	C526	C527	C528	C529	C530	C531	C532	C533	C534	C535	C536	C537	C538	C539	C540	C541	C542	C543	C544	C545	C546	C547	C548	C549	C550	C551	C552	C553	C554	C555	C556	C557	C558	C559	C560	C561	C562	C563	C564	C565	C566	C567	C568	C569	C570	C571	C572	C573	C574	C575	C576	C577	C578	C579	C580	C581	C582	C583	C584	C585	C586	C587	C588	C589	C590	C591	C592	C593	C594	C595	C596	C597	C598	C599	C600	C601	C602	C603	C604	C605	C606	C607	C608	C609	C610	C611	C612	C613	C614	C615	C616	C617	C618	C619	C620	C621	C622	C623	C624	C625	C626	C627	C628	C629	C630	C631	C632	C633	C634	C635	C636	C637	C638	C639	C640	C641	C642	C643	C644	C645	C646	C647	C648	C649	C650	C651	C652	C653	C654	C655	C656	C657	C658	C659	C660	C661	C662	C663	C664	C665	C666	C667	C668	C669	C670	C671	C672	C673	C674	C675	C676	C677	C678	C679	C680	C681	C682	C683	C684	C685	C686	C687	C688	C689	C690	C691	C692	C693	C694	C695	C696	C697	C698	C699	C700	C701	C702	C703	C704	C705	C706	C707	C708	C709	C710	C711	C712	C713	C714	C715	C716	C717	C718	C719	C720	C721	C722	C723	C724	C725	C726	C727	C728	C729	C730	C731	C732	C733	C734	C735	C736	C737	C738	C739	C740	C741	C742	C743	C744	C745	C746	C747	C748	C749	C750	C751	C752	C753	C754	C755	C756	C757	C758	C759	C760	C761	C762	C763	C764	C765	C766	C767	C768	C769	C770	C771	C772	C773	C774	C775	C776	C777	C778	C779	C780	C781	C782	C783	C784	C785	C786	C787	C788	C789	C790	C791	C792	C793	C794	C795	C796	C797	C798	C799	C800	C801	C802	C803	C804	C805	C806	C807	C808	C809	C810	C811	C812	C813	C814	C815	C816	C817	C818	C819	C820	C821	C822	C823	C824	C825	C826	C827	C828	C829	C830	C831	C832	C833	C834	C835	C836	C837	C838	C839	C840	C841	C842	C843	C844	C845	C846	C847	C848	C849	C850	C851	C852	C853	C854	C855	C856	C857	C858	C859	C860	C861	C862	C863	C864	C865	C866	C867	C868	C869	C870	C871	C872	C873	C874	C875	C876	C877	C878	C879	C880	C881	C882	C883	C884	C885	C886	C887	C888	C889	C890	C891	C892	C893	C894	C895	C896	C897	C898	C899	C900	C901	C902	C903	C904	C905	C906	C907	C908	C909	C910	C911	C912	C913	C914	C915	C916	C917	C918	C919	C920	C921	C922	C923	C924	C925	C926	C927	C928	C929	C930	C931	C932	C933	C934	C935	C936	C937	C938	C939	C940	C941	C942	C943	C944	C945	C946	C947	C948	C949	C950	C951	C952	C953	C954	C955	C956	C957	C958	C959	C960	C961	C962	C963	C964	C965	C966	C967	C968	C969	C970	C971	C972	C973	C974	C975	C976	C977	C978	C979	C980	C981	C982	C983	C984	C985	C986	C987	C988	C989	C990	C991	C992	C993	C994	C995	C996	C997	C998	C999	C1000	C1001	C1002	C1003	C1004	C1005	C1006	C1007	C1008	C1009	C1010	C1011	C1012	C1013	C1014	C1015	C1016	C1017	C1018	C1019	C1020	C1021	C1022	C1023	C1024	C1025	C1026	C1027	C1028	C1029	C1030	C1031	C1032	C1033	C1034	C1035	C1036	C1037	C1038	C1039	C1040	C1041	C1042	C1043	C1044	C1045	C1046	C1047	C1048	C1049	C1050	C1051	C1052	C1053	C1054	C1055	C1056	C1057	C1058	C1059	C1060	C1061	C1062	C1063	C1064	C1065	C1066	C1067	C1068	C1069	C1070	C1071	C1072	C1073	C1074	C1075	C1076	C1077	C1078	C1079	C1080	C1081	C1082	C1083	C1084	C1085	C1086	C1087	C1088	C1089	C1090	C1091	C1092	C1093	C1094	C1095	C1096	C1097	C1098	C1099	C1100	C1101	C1102	C1103	C1104	C1105	C1106	C1107	C1108	C1109	C1110	C1111	C1112	C1113	C1114	C1115	C1116	C1117	C1118	C1119	C1120	C1121	C1122	C1123	C1124	C1125	C1126	C1127	C1128	C1129	C1130	C1131	C1132	C1133	C1134	C1135	C1136	C1137	C1138	C1139	C1140	C1141	C1142	C1143	C1144	C1145	C1146	C1147	C1148	C1149	C1150	C1151	C1152	C1153	C1154	C1155	C1156	C1157	C1158	C1159	C1160	C1161	C1162	C1163	C1164	C1165	C1166	C1167	C1168	C1169	C1170	C1171	C1172	C1173	C1174	C1175	C1176	C1177	C1178	C1179	C1180	C1181	C1182	C1183	C1184	C1185	C1186	C1187	C1188	C1189	C1190	C1191	C1192	C1193	C1194	C1195	C1196	C1197	C1198	C1199	C1200	C1201	C1202	C1203	C1204	C1205	C1206	C1207	C1208	C1209	C1210	C1211	C1212	C1213	C1214	C1215	C1216	C1217	C1218	C1219	C1220	C1221	C1222	C1223	C1224	C1225	C1226	C1227	C1228	C1229	C1230	C1231	C1232	C1233	C1234	C1235	C1236	C1237	C1238	C1239	C1240	C1241	C1242	C1243	C1244	C1245	C1246	C1247	C1248	C1249	C1250	C1251	C1252	C1253	C1254	C1255	C1256	C1257	C1258	C1259	C1260	C1261	C1262	C1263	C1264	C1265	C1266	C1267	C1268	C1269	C1270	C1271	C1272	C1273	C1274	C1275	C1276	C1277	C1278	C1279	C1280	C1281	C1282	C1283	C1284	C1285	C1286	C1287	C1288	C1289	C1290	C1291	C1292	C1293	C1294	C1295	C1296	C1297	C1298	C1299	C1300	C1301	C1302	C1303	C1304	C1305	C1306	C1307	C1308	C1309	C1310	C1311	C1312	C1313	C1314	C1315	C1316	C1317	C1318	C1319	C1320	C1321	C1322	C1323	C1324	C1325	C1326	C1327	C1328	C1329	C1330	C1331	C1332	C1333	C1334	C1335	C1336	C1337	C1338	C1339	C1340	C1341	C1342	C1343	C1344	C1345	C1346	C1347	C1348	C1349	C1350	C1351	C1352	C1353	C1354	C1355	C1356	C1357	C1358	C1359	C1360	C1361	C1362	C1363	C1364	C1365	C1366	C1367	C1368	C1369	C1370	C1371	C1372	C1373	C1374	C1375	C1376	C1377	C1378	C1379	C1380	C1381	C1382	C1383	C1384	C1385	C1386	C1387	C1388	C1389	C1390	C1391	C1392	C1393	C1394	C1395	C1396	C1397	C1398	C1399	C1400	C1401	C1402	C1403	C1404	C1405	C1406	C1407	C1408	C1409	C1410	C1411	C1412	C1413	C1414	C1415	C1416	C1417	C1418	C1419	C1420	C1421	C1422	C1423	C1424	C1425	C1426	C1427	C1428	C1429	C1430	C1431	C1432	C1433	C1434	C1435	C1436	C1437	C1438	C1439	C1440	C1441	C1442	C1443	C1444	C1445	C1446	C1447	C1448	C1449	C1450	C1451	C1452	C1453	C1454	C1455	C1456	C1457	C1458	C1459	C1460	C1461	C1462	C1463	C1464	C1465	C1466	C1467	C1468	C1469	C1470	C1471	C1472	C1473	C1474	C1475	C1476	C1477	C1478	C1479	C1480	C1481	C1482	C1483	C1484	C1485	C1486	C1487	C1488	C1489	C1490	C1491	C1492	C1493	C1494	C1495	C1496	C1497	C1498	C1499	C1500	C1501	C1502	C1503	C1504	C1505	C1506	C1507	C1508	C1509	C1510	C1511	C1512	C1513	C1514	C1515	C1516	C1517	C1518	C1519	C1520	C1521	C1522	C1523	C1524	C1525	C1526	C1527	C1528	C1529	C1530	C1531	C1532	C1533	C1534	C1535	C1536	C1537	C1538	C1539	C1540	C1541	C1542	C1543	C1544	C1545	C1546	C1547	C1548	C1549	C1550	C1551	C1552	C1553	C1554	C1555	C1556	C1557	C1558	C1559	C1560	C1561	C1562	C1563	C1564	C1565	C1566	C1567	C1568	C1569	C1570	C1571	C1572	C1573	C1574	C1575	C1576	C1577	C1578	C1579	C1580	C1581	C1582	C1583	C1584	C1585	C1586	C1587	C1588	C1589	C1590	C1591	C1592	C1593	C1594	C1595	C1596	C1597	C1598	C1599	C1600	C1601	C1602	C1603	C1604	C1605	C1606	C1607	C1608	C1609	C1610	C1611	C1612	C1613	C1614	C1615	C1616	C1617	C1618	C1619	C1620	C1621	C1622	C1623	C1624	C1625	C1626	C1627	C1628	C1629	C1630	C1631	C1632	C1633	C1634	C1635	C1636	C1637	C1638	C1639	C1640	C1641	C1642	C1643	C1644	C1645	C1646	C1647	C1648	C1649	C1650	C1651	C1652	C1653	C1654	C1655	C1656	C1657	C1658	C1659	C1660	C1661	C1662	C1663	C1664	C1665	C1666	C1667	C1668	C1669	C1670	C1671	C1672	C1673	C1674	C1675	C1676	C1677	C1678	C1679	C1680	C1681	C1682	C1683	C1684	C1685	C1686	C1687	C1688	C1689	C1690	C1691	C1692	C1693	C1694	C1695	C1696	C16
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SECTION 8 SERVICE MANUAL ADDENDUM

The following modifications now exist in the BTL-301 and BTL-304 VHF FM Transceivers. The revisions pertain to the Transmitter Board 501-183 on which the power regulator components are now located. Effective April, 1975.

ADDENDUM CONTENTS

- 7-1 Cross Reference To Power Regulator Board
- 7-2 Component List To: Transmitter Board 501-183
- 7-3 Transmitter Board Parts Placement Diagram
- 7-4 Transmitter Board Parts Overlay Diagram
- 7-5 Receiver Board Parts Placement Diagram
- 7-6 Receiver Board Parts Overlay Diagram
- 7-7 Schematic with Voltages (BTL-301/304)

8-1 CROSS REFERENCE TO POWER REGULATOR BOARD

This manual revision reflects the relocation of the power regulator circuit on the transmitter board. The circuit is the same as shown in Section 6. Below is a cross reference listing the new circuit symbols.

POWER REGULATOR BOARD 302-342 PARTS LIST

CROSS REFERENCE

Item No.	Description	Part No.
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501-183 TRANSMITTER BOARD

Item #

RESISTORS

R401	3.3K 10% ¼W	4701-0332-042
R402	150 ohms 10% ½W	4701-0151-044
R403	150 ohms 10% ½W	4701-0151-044

R251

R252

R253

CAPACITORS

C401	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C402	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C403	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C404	10 uf 20% 25V TANT	1515-0100-005
C405	150 pf 20% 50V Z5F	1523-0151-002
C406	10 uf 20% 25V TANT	1515-0100-005
C407	.01 uf +80-20% 50V YM (Disc.)	1503-0103-007
C408	10 uf 20% 25V TANT	1515-0100-005

C278

C279

C280

C281

C282

C283

C284

C285

TRANSISTORS

Q401	Silicon SPS 952	4801-0000-010
Q402	Silicon Power PNP SJE 1608	4802-0000-003

Q210

Q213

All tuning procedures remain as described in Section 7 and 6. This section contains transmitter board and receiver board parts placement diagrams with wire tie points cross referenced to the schematic diagrams.

8-2 TRANSMITTER BOARD 501-183

Item No.	Description	Part No.	Item No.	Description	Part No.
RESISTORS			CAPACITORS		
All Resistors are $\pm 10\%$, $\frac{1}{4}W$, unless otherwise noted.			C201	.01mf, 10%, 100V (Mylar Film)	1508-0103-610
R201	10K		C202	47pf, 5%, 50V (Mica)	1507-0470-001
R202	100K		C203	10mf, 85°C, 10V (Electrolytic)	1513-0100-001
R203	10K		C204	.1mf, 20%, 12V (Disc.)	1502-0104-005
R204	Trimmer, 10K	4751-0103-001	C205	25mf, 85°C, 10V (Electrolytic)	1513-0250-001
R205	3.9K		C206	.47mf, +80 -20%, 3V (Disc.)	1502-0474-001
R206	2.7K		C207	.1mf, 20%, 12V (Disc.)	1502-0104-005
R207	6.8K		C208	.0033mf, 10%, 100V (Mylar Film)	1508-0332-610
R208	68K		C209	.022mf, 10%, 100V (Mylar Film)	1508-0223-610
R209	18K		C210	.1mf, 20%, 12V (Disc.)	1502-0104-005
R210	470 ohm		C211	.47mf, +80 -20%, 3V (Disc.)	1502-0474-001
R211	10K		C212	.1mf, 20%, 12V (Disc.)	1502-0104-005
R212	39K		C213	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
R213	120K		C214	.05mf, +80 -20%, 16V (Disc.)	1502-0503-003
R214	27K		C215	10mf, 20%, 25V (Tantalum)	1515-0100-005
R215	39K		C217	4-40pf MICA Trimmer (38-50 MHz)	1517-0000-009
R216	Trimmer, 10K	4751-0103-001		4-60pf MICA Trimmer (29-38 MHz)	1517-0000-005
R217	470 ohm		C218	90-400pf, MICA Trimmer	1517-0000-008
R218	330 ohm, 5%		C219	470pf, 5%, 500v, MICA (29-32 MHz)	1504-0471-505
R219	10 ohm (29-47 MHz)			390pf, 5%, 500v, MICA (32-35 MHz)	1504-0391-505
	15 ohm (47-50 MHz)			300pf, 5%, 500v, MICA (35-38 MHz)	1504-0301-505
R220	3.3 ohm	4701-0339-042		270pf, 5%, 500v, MICA (38-41 MHz)	1504-0271-505
R221	18 ohm			220pf, 5%, 500v, MICA (41-44 MHz)	1504-0221-505
R222	10 ohm			180pf, 5%, 500v, MICA (44-47 MHz)	1504-0181-505
R223	10 ohm		C220	150pf, 5%, 500v, MICA (47-50 MHz)	1504-0151-505
R224	22 ohm			390pf, 5%, 500V MICA (29-32 MHz)	1504-0391-505
R225	100 ohm			360pf, 5%, 500V MICA (32-35 MHz)	1504-0361-505
R226	47 ohm			300pf, 5%, 500V MICA (35-38 MHz)	1504-0301-505
R227	270 ohm			250pf, 5%, 500V MICA (38-41 MHz)	1504-0251-505
R228	470 ohm (29-32 MHz)			200pf, 5%, 500V MICA (41-44 MHz)	1504-0201-505
	680 ohm (32-35 MHz)			180pf, 5%, 500V MICA (44-47 MHz)	1504-0181-505
	820 ohm (35-38 MHz)			150pf, 5%, 500V MICA (47-50 MHz)	1504-0151-505
	1.5K ohm (38-41 MHz)		C221	300pf, 5%, 50v MICA (29-32 MHz)	1506-0301-550
	1.8K ohm (41-44 MHz)			250pf, 5%, 50v MICA (32-35 MHz)	1506-0251-550
	2.2K ohm (44-47 MHz)			200pf, 5%, 50v MICA (35-38 MHz)	1506-0201-550
	2.7K ohm (47-50 MHz)			180pf, 5%, 50v MICA (38-41 MHz)	1506-0181-550
R229	1.5K			150pf, 5%, 50v MICA (41-44 MHz)	1506-0151-550
R230	10 ohm			120pf, 5%, 50v MICA (44-47 MHz)	1506-0121-550
R231	100 ohm		C222	100pf, 5%, 50v MICA (47-50 MHz)	1506-0101-550
R235	82K			120pf, 5%, 50V MICA (29-32 MHz)	1506-0121-550
R236	4.7K			100pf, 5%, 50V MICA (32-35 MHz)	1506-0101-550
R237	100 ohm			82pf, 5%, 50V MICA (35-38 MHz)	1506-0820-550
R238	150 ohm			75pf, 5%, 50V MICA (38-41 MHz)	1506-0750-550
R239	27K			56pf, 5%, 50V MICA (41-47 MHz)	1506-0560-550
R240	2.7K			47pf, 5%, 50V MICA (47-50 MHz)	1506-0470-550
R241	100 ohm, 1W, 10%	4701-0101-042	C223	100pf, 5%, 50V MICA (29-32 MHz)	1506-0101-550
R242	100K			82pf, 5%, 50v MICA (32-38 MHz)	1506-0820-550
R243	68K			56pf, 5%, 50V MICA (38-41 MHz)	1506-0560-550
R244	100K			47pf, 5%, 50V MICA (41-47 MHz)	1506-0470-550
R245	120 ohm			36pf, 5%, 50V MICA (47-50 MHz)	1506-0360-550
R246	180 ohm		C224	.01, +80 -20%, 16V (Disc.)	1502-0103-003
R247	47K		C225	220pf, 5%, 50V MICA (29-35 MHz)	1506-0221-550
R248	27K			150pf, 5%, 50V MICA (35-41 MHz)	1506-0151-550
R250	150 ohm			100pf, 5%, 50V MICA (41-44 MHz)	1506-0101-550
R251	3.3K			82pf, 5%, 50V MICA (44-50 MHz)	1506-0820-550
R252	150 ohm, $\frac{1}{2}W$ 10%	4701-0151-044			
R253	150 ohm, $\frac{1}{2}W$ 10%	4701-0151-044			

Item No.	Description	Part No.
CAPACITORS		
C226	470pf, 5%, 50V MICA (29-35 MHz)	1506-0471-550
	360pf, 5%, 50V MICA (35-50 MHz)	1506-0361-550
C227	150pf, 5%, 50V MICA (29-35 MHz)	1506-0151-550
	100pf, 5%, 50V MICA (35-41 MHz)	1506-0101-550
	82pf, 5%, 50V MICA (41-44 MHz)	1506-0820-550
	75pf, 5%, 50V MICA (44-50 MHz)	1506-0750-550
C228	.01, +80 -20%, 16V (Disc.)	1502-0130-003
C229	360pf, 5%, 50V MICA (29-32 MHz)	1506-0361-550
	300pf, 5%, 50V MICA (32-35 MHz)	1506-0301-550
	270pf, 5%, 50V MICA (35-38 MHz)	1506-0271-550
	250pf, 5%, 50V MICA (38-41 MHz)	1506-0251-550
	220pf, 5%, 50V MICA (41-44 MHz)	1506-0221-550
	180pf, 5%, 50V MICA (44-50 MHz)	1506-0181-550
C230	1000pf, 5%, 50V MICA (29-41 MHz)	1507-0102-004
	470pf, 5%, 50V MICA (41-50 MHz)	1506-0471-550
C231	.005mf, +80 -20%, 500V Z5U (Disc.)	1503-0502-002
C232	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C233	300pf, 5%, 50V MICA (29-32 MHz)	1506-0301-550
	220pf, 5%, 50V MICA (32-38 MHz)	1506-0221-550
	200pf, 5%, 50V MICA (38-41 MHz)	1506-0201-550
	150pf, 5%, 50V MICA (41-44 MHz)	1506-0151-550
	120pf, 5%, 50V MICA (44-50 MHz)	1506-0121-550
C235	680pf, 5%, 50V MICA (29-32 MHz)	1506-0681-550
	560pf, 5%, 50V MICA (32-38 MHz)	1506-0561-550
	390pf, 5%, 50V MICA (38-44 MHz)	1506-0391-550
	220pf, 5%, 50V MICA (44-50 MHz)	1506-0221-550
C236	1000pf, 5%, 50v (Mica)	1507-0102-004
C237	.01mf, +80 -20%, 16V (Disc.)	1502-0103-003
C238	390pf, 5%, 50V MICA (29-32 MHz)	1506-0391-550
	360pf, 5%, 50V MICA (32-38 MHz)	1506-0361-550
	270pf, 5%, 50V MICA (38-44 MHz)	1506-0271-550
	180pf, 5%, 50V MICA (44-50 MHz)	1506-0181-550
C239	.1mf, 20%, 12V (Disc.)	1502-0104-005
C240	27pf, 10%, 500V, NPO (Disc.)	1500-0270-605
C241	5pf, 10%, 500V NPO (Disc.)	1500-0050-905
C242	.1mf, 20%, 12V (Disc.)	1502-0104-005
C243	150pf, 5%, 50V (Mica)	1506-0151-550
C244	Same as C243	
C246	2-18pf, Trimmer	1517-0000-001
C247	39pf, 50v, 5% 00-580	1500-0390-550
*C248	Same as C246	
*C249	Same as C247	
*C250	Same as C246	
*C251	Same as C247	
*C252	Same as C246	
*C253	Same as C247	
C254	4-60pf MICA Trimmer (29-38 MHz)	1517-0000-005
C254	4-40pf, MICA Trimmer (38-50 MHz)	1517-0000-009
C255	47pf, 5%, 500V (Mica)	1504-0470-505
C269	300pf, 5%, 500v MICA (29-38 MHz)	1504-0301-505
	270pf, 5%, 500v MICA (38-41 MHz)	1504-0271-505
	1000pf, 5% 500v MICA (41-44MHz)	1504-0102-505
	180pf, 5%, 500v MICA (44-47 MHz)	1504-0181-505
	150pf, 5%, 500v MICA (47-50 MHz)	1504-0151-505
C270	1000pf, 5%, 500v (Mica)	1504-0102-505
C271	390pf, 5%, 50v MICA (47-50 MHz)	1506-0391-550
	560pf, 5%, 50v MICA (29-47 MHz)	1506-0561-550

Item No.	Description	Part No.
C272	.0047mf, 10%, 100V (Mylar Film)	1508-0472-610
C273	.01 uf, +80-20%, 50V, YM (Disc.)	1503-0103-007
C274	.01 uf, +80-20%, 50V, YM (Disc.)	1503-0103-007
C275	.01 uf, +80-20%, 50V, YM (Disc.)	1503-0103-007
C276	.01 uf, +80-20%, 50V, YM (Disc.)	1503-0103-007
C277	200pf, 5%, 50v MICA (29-35 MHz)	1506-0201-550
	100pf, 5%, 50v MICA (35-50 MHz)	1506-0101-550
C278	.01vf +80 -20% 50v YM (Disc)	1503-0103-007
C279	.01vf +80 -20% 50v YM (Disc)	1503-0103-007
C280	.01vf +80 -20% 50v YM (Disc)	1503-0103-007
C281	10vf 20% 25v Tant	1515-0100-005
C282	150vf 20% 50v 25F	1513-0151-002
C283	10vf 20% 25v Tant	1515-0100-005
C284	.01vf +80 -20% 50v YM (Disc)	1503-0103-007
C285	10vf 20% 25v Tant	1515-0100-005

*Used on BTL-304 ONLY

COILS

L201	Coil Final Output (29-35 MHz)	1801-3240-400
	Coil Final Output (35-41 MHz)	1801-3208-700
	Coil Final Output (41-50 MHz)	1801-3219-600
L202	Coil, Antenna Output (29-41 MHz)	1801-3208-600
	Coil, Antenna Output (41-50 MHz)	1801-1274-201
L203	Coil, RF Choke	1803-3189-800
L204	Choke Bead Coil	1803-1245-900
L206	Coil, Modulator (29-32 MHz)	1800-3249-000
	Coil, Modulator (32-41 MHz)	1800-3189-200
	Coil, Modulator (41-50 MHz)	1800-3208-300
L208	Ferrite Bead	2502-0000-001
L209	Same as L208	
L210	Same as L208	
L211	Same as L208	
L212	Same as L208	
T201	Transformer, SWR Bridge	1800-3190-100
T202	Transformer, Driver (Violet)	1800-3189-701
T203	Transformer (Blue)	1800-3189-601
T204	Transformer (Green)	1800-3189-501
T205	Transformer (Yellow)	1800-3189-401
T206	Transformer (Orange)	1800-3189-301

TRANSISTORS

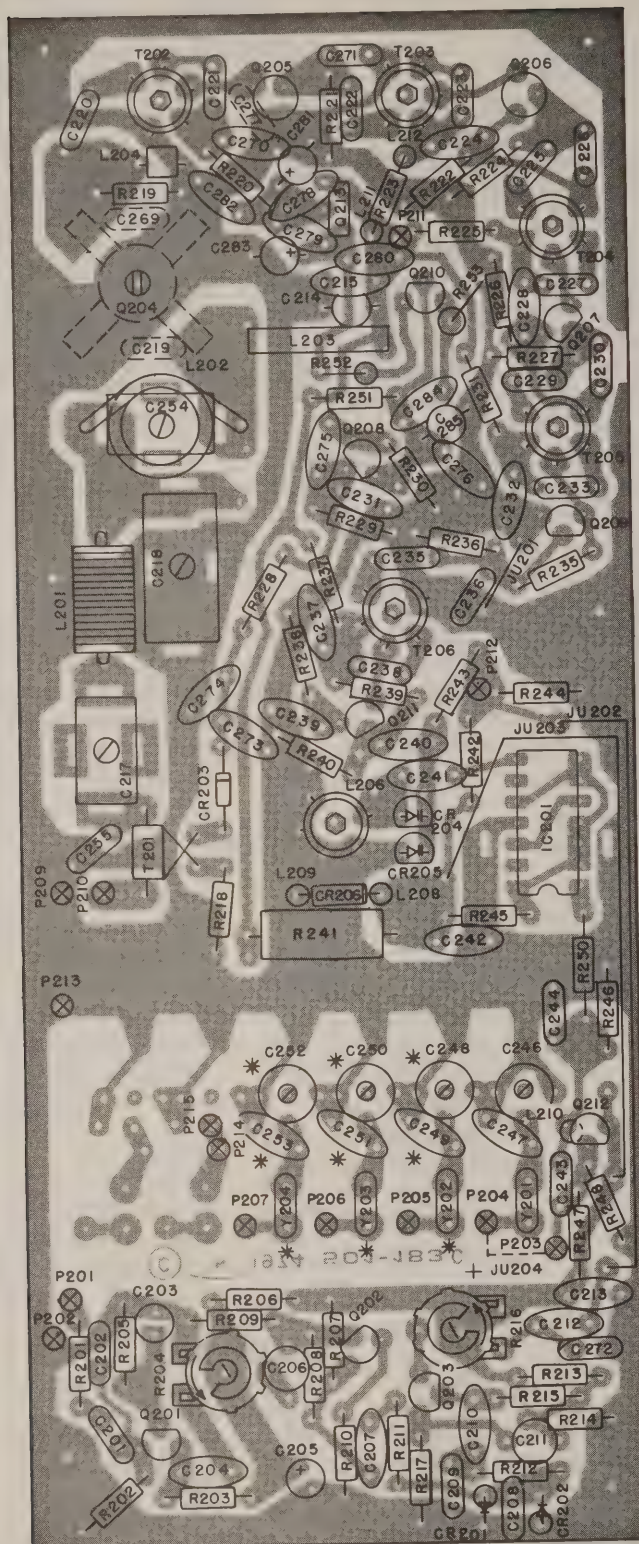
Q201	Junct. FET	4811-0000-030
Q202	Silicon NPN	4801-0000-010
Q203	Same as Q202	
Q204	Silicon, RF Power NPN	4804-3169-503
Q205	Silicon, RF Power NPN	4804-3169-604
Q206	Silicon NPN	4804-0000-015
Q207	Silicon NPN (BT)	4801-0000-003
Q208	Silicon NPN	4801-0000-010
Q209	Silicon NPN (BT)	4801-0000-003
Q210	Silicon NPN	4801-0000-010
Q211	Silicon NPN (BT)	4801-0000-003
Q212	Same as Q211	
Q213	Silicon PNP	4802-0000-003

NOTE: BT=Blue Top

INTEGRATED CIRCUITS

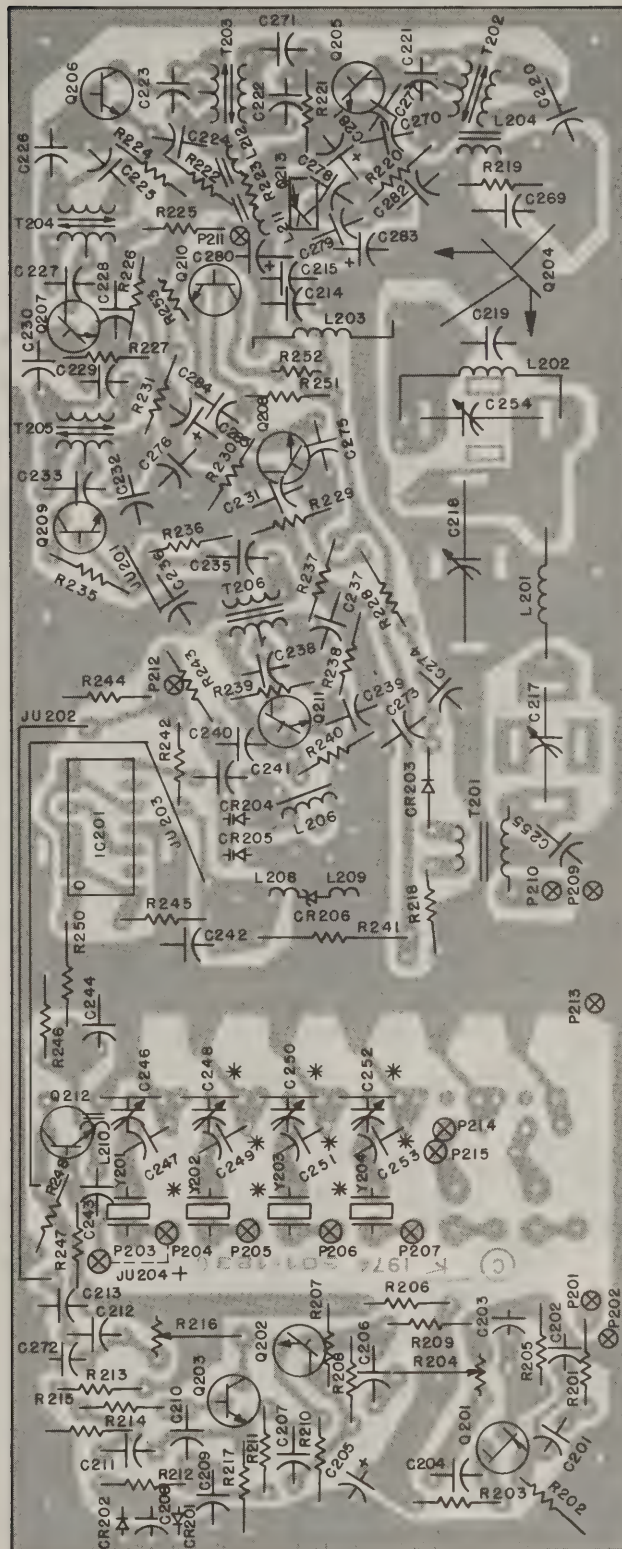
IC201	IC, Divider	3130-3157-607
	Shield, I.C.	2508-1265-900

* SYMBOL INDICATES USED IN BTL-304 ONLY
+ SYMBOL INDICATES USED IN BTL-301 AND BTL-301T

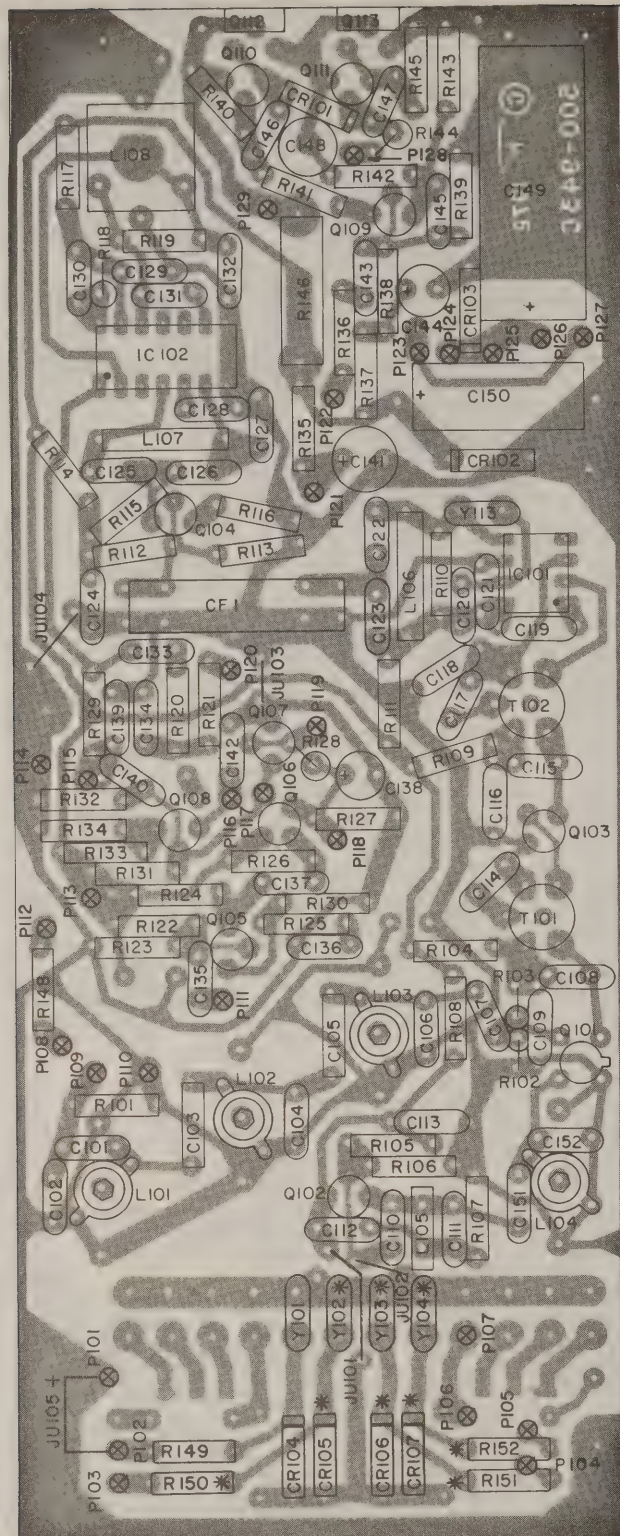


BTL-301 & BTL-304

TRANSMITTER BOARD - 501-183



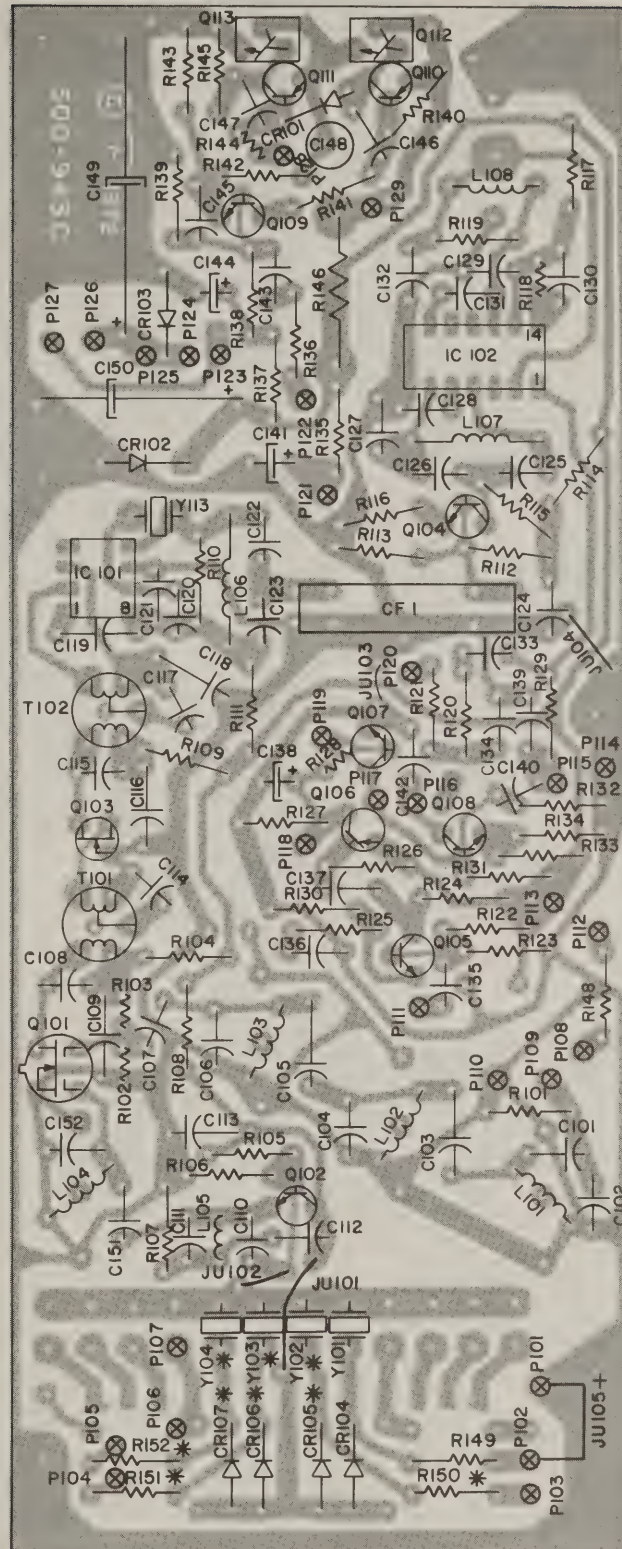
RECEIVER BOARD 500-943



* SYMBOL INDICATES USED IN BTL-304 ONLY
 + SYMBOL INDICATES USED IN BTL-301 AND BTL-301T

8-5 RECEIVER BOARD PARTS PLACEMENT DIAGRAM

RECEIVER BOARD 500-943



* SYMBOL INDICATES USED IN BTL-304 ONLY
 + SYMBOL INDICATES USED IN BTL-301 AND BTL-301T

8-6 RECEIVER BOARD PARTS OVERLAY DIAGRAM

BTL-300 SERIES

RECEIVED

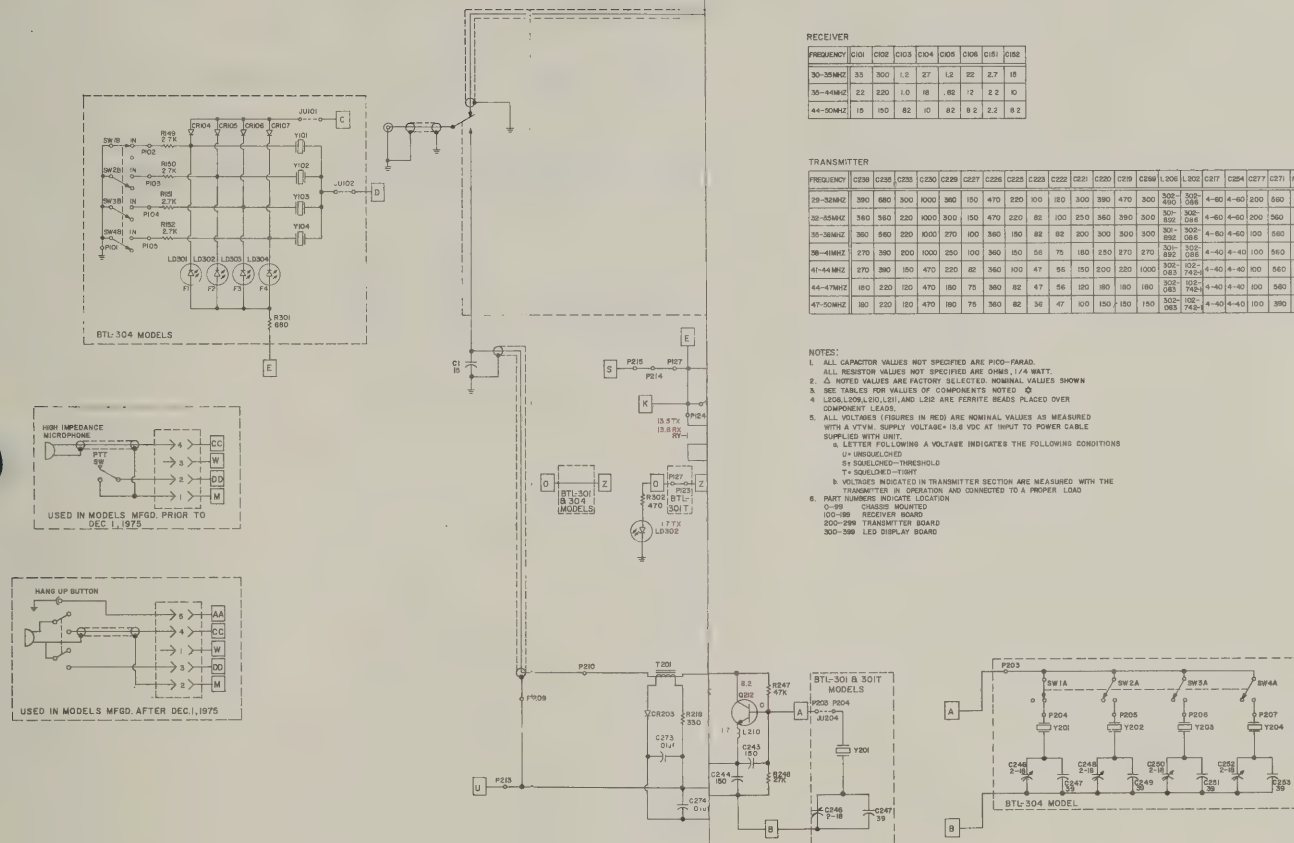
FREQUENCY	C101	C102	C103	C104	C105	C106	C107	C108
30-35MHz	55	300	1.2	27	1.2	22	2.7	15
35-44MHz	2.2	220	1.0	18	.62	12	2.2	10
44-50MHz	15	150	.82	10	.82	8.2	2.2	8

TRANSMITTER

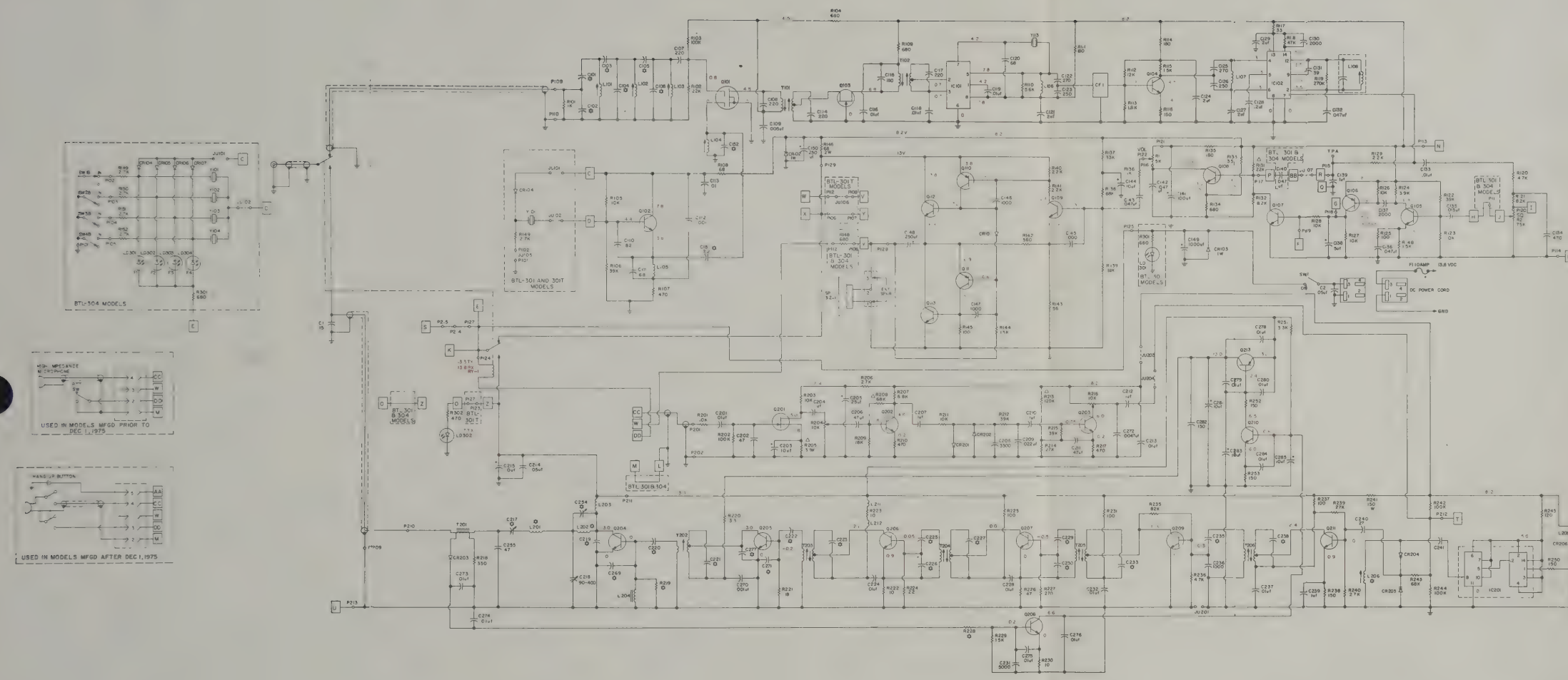
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NOTES:

- ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-PICFARD.
ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS, 1/4 WATT.
ALL LOGIC LEVELS ARE FACTORY SELECTED. NOMINAL VALUES SHOWN
3. SEE PARTS LIST FOR VALUES OF COMPONENTS NOTED Q
4. LOGIC LEVELS 0,1,2,0,1,2,1, AND L2,2 ARE FERRITE BEADS PLACED OVER
COMPONENT LEADS.
5. ALL VOLTAGE FIGURES IN RED ARE NOMINAL VALUES AS MEASURED
WITH A VTVM. SUPPLY VOLTAGE IS 5.0V AC AT INPUT TO POWER CABLE
SUPPLIED WITH UNIT.
6. ALL LETTERS FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
a UNBOUNDED
b SQUELCHED-THRESHOLD
c SQUELCHED-TIME
d VOLTAGES INDICATED IN TRANSMITTER SECTION ARE MEASURED WITH THE
TRANSMITTER IN OPERATION AND CONNECTED TO A PROPER LOAD
7. PART NOTATIONS INDICATE LOCATION
0-99 CHASSIS MOUNTED
100-99 RECEIVER BOARD
200-999 TRANSMITTER BOARD
300-999 DISK DISPLAY BOARD



8-7 SCHEMATIC WITH VOLTAGES



BTL-300 SERIES

RECEIVER

FREQUENCY	10	20	30	40	50	60	70	80	90	100
20-30MHz	11	10	9	8	7	6	5	4	3	2
30-40MHz	11	10	9	8	7	6	5	4	3	2
40-50MHz	11	10	9	8	7	6	5	4	3	2

TRANSMITTER

FREQUENCY	10	20	30	40	50	60	70	80	90	100
20-30MHz	11	10	9	8	7	6	5	4	3	2
30-40MHz	11	10	9	8	7	6	5	4	3	2
40-50MHz	11	10	9	8	7	6	5	4	3	2

NOTES

1. ALL CAPACITOR VALUES NOT SPECIFIED ARE PICO-FARAD.
2. ALL RESISTOR VALUES NOT SPECIFIED ARE OHMS 1/4 WATT.
3. ALL VOLTAGE VALUES ARE FACTORY SELECTED NOMINAL VALUES SHOWN.
4. SEE TABLES FOR VALUES OF COMPONENTS NOTED IN.
5. ALL VOLTAGES (POSITIVE OR NEGATIVE) ARE MEASURED AS MEASURED WITH A VTM SUPPLY VOLTAGE +13.8 VDC AT INPUT TO POWER CABLE.
6. A LETTER FOLLOWING A VOLTAGE INDICATES THE FOLLOWING CONDITIONS:
 - A: UNBOUNDED
 - B: BOUNDED - THRESHOLD
 - C: BOUNDED - THRESHOLD
 - D: BOUNDED - THRESHOLD
 - E: BOUNDED - THRESHOLD
 - F: BOUNDED - THRESHOLD
 - G: BOUNDED - THRESHOLD
 - H: BOUNDED - THRESHOLD
 - I: BOUNDED - THRESHOLD
 - J: BOUNDED - THRESHOLD
 - K: BOUNDED - THRESHOLD
 - L: BOUNDED - THRESHOLD
 - M: BOUNDED - THRESHOLD
 - N: BOUNDED - THRESHOLD
 - O: BOUNDED - THRESHOLD
 - P: BOUNDED - THRESHOLD
 - Q: BOUNDED - THRESHOLD
 - R: BOUNDED - THRESHOLD
 - S: BOUNDED - THRESHOLD
 - T: BOUNDED - THRESHOLD
 - U: BOUNDED - THRESHOLD
 - V: BOUNDED - THRESHOLD
 - W: BOUNDED - THRESHOLD
 - X: BOUNDED - THRESHOLD
 - Y: BOUNDED - THRESHOLD
 - Z: BOUNDED - THRESHOLD

8-7 SCHEMATIC WITH VOLTAGES

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SECTION 9 SERVICE MANUAL ADDENDUM

The following modifications now exist in the BTL-301 and BTL-304 VHF FM Transceivers. The revisions pertain to the Relay Board 501-265. Effective December, 1975.

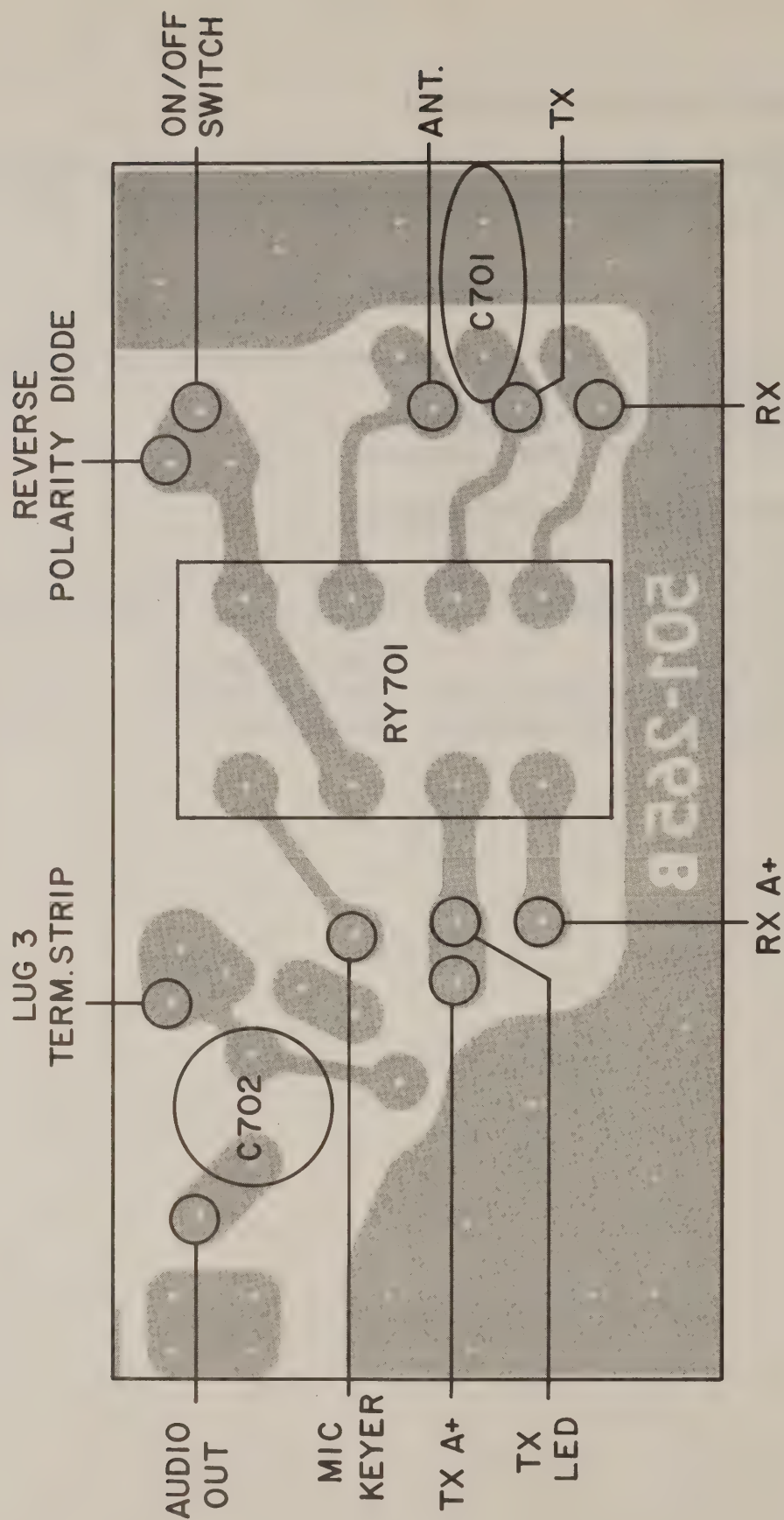
CONTENTS

- 9-1 Component List plus cross reference to previously used schematic numbers
- 9-2 Relay Board Parts Placement Diagram
- 9-3 Relay Board Parts Overlay Diagram

9-1 COMPONENT LIST PLUS CROSS REFERENCE

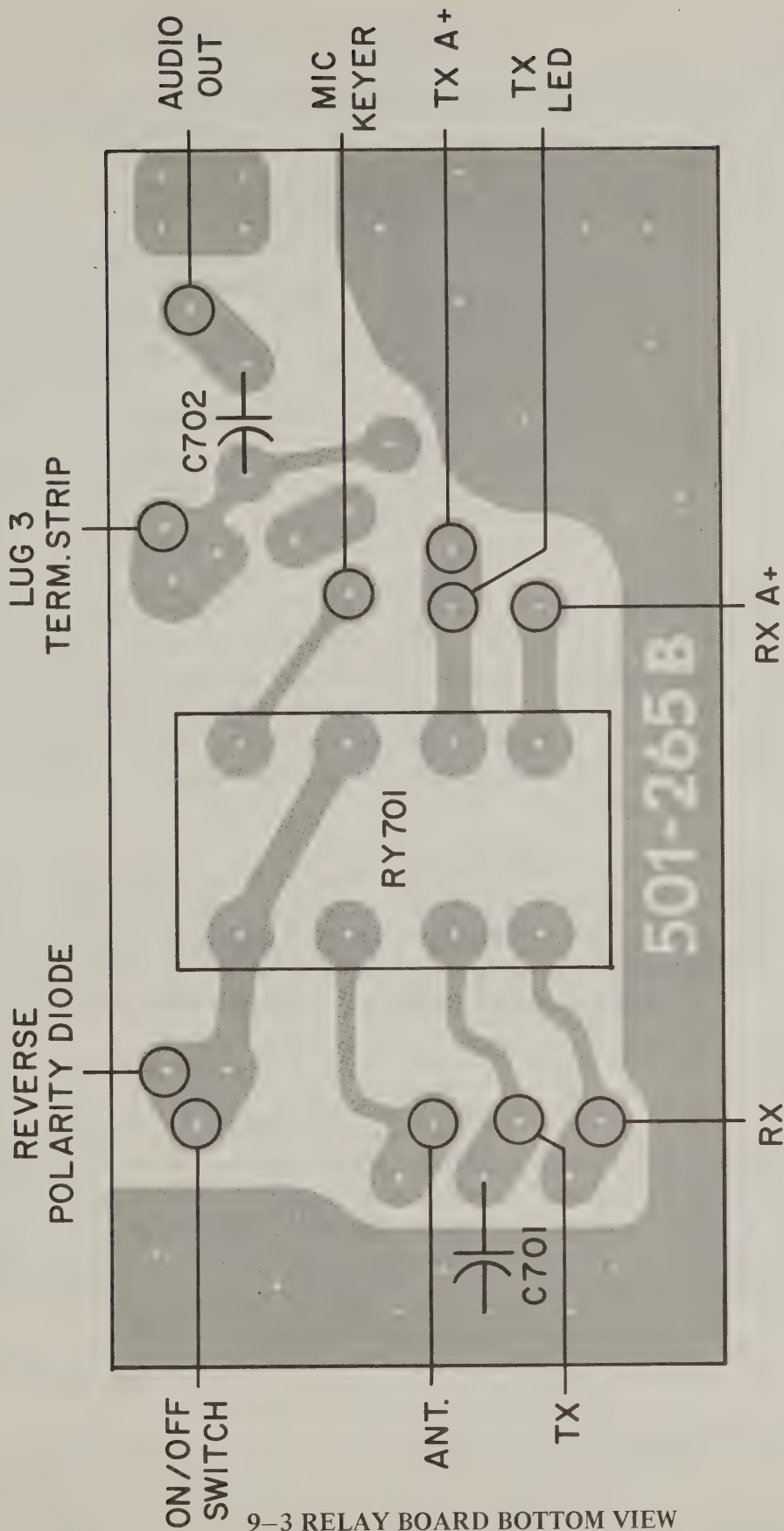
Item No.	Description	Part No.	Cross Reference Item No.
RY-701	Relay 302-519	4500-3251-900	RY1
C701	CAP CD 15 PF, 10% NPO 50V	1500-0150-650	C1
C702	CAP E 250 μ f, 16V 850 Type U	1513-0251-002	C148

RELAY BOARD 501-265



9-2 RELAY BOARD PARTS PLACEMENT DIAGRAM

RELAY BOARD 501-265



9-3 RELAY BOARD BOTTOM VIEW

SECTION 10 C.T.C.S.S. ACCESSORY ADDENDUM

This accessory provides a continuous tone coded sub-audible squelch function for the BTL-301 and BTL-304

CONTENTS

- 10-1 Circuit Description
- 10-2 Adjustment Procedure
- 10-3 Specifications
- 10-4 Voltage Chart
- 10-5 Schematic
- 10-6 Parts Placement Diagram
- 10-7 Parts Overlay
- 10-8 Component List

10-1 CIRCUIT DESCRIPTION

Detected signal from IC102 is fed to IC801 and IC802; IC801 is a high-pass filter which removes tone frequencies from the audio. IC802 is a low-pass filter which selects the signalling frequency and removes audio, feeding the signalling frequency to IC803 and IC804 which are the filter for the code frequency. IC803 is the frequency determining network and IC804 is an amplifier. IC805 is a detector which, when the proper frequency is present at the filter output, switches Q107 off, unsquelching the receiver.

The Microphone Hang-up Button is connected to Pin 6 of IC804. When the Hang-up Button is grounded, the circuit operates as above. When the Hang-up Button is ungrounded, the decoder is disabled leaving the receiver under noise-squelch control. Also, IC803 and IC804 go into oscillation at the tone code frequency and provide encode tone through R803; the tone deviation control to the transmitter.

10-2 ADJUSTMENT PROCEDURE

- a. Connect the unit to a Dummy Load
- b. Couple an F.M. Modulation Meter's RF pick-up to the transmitter
- c. With the Microphone Hang-up Button ungrounded, key the transmitter
- d. Adjust the Tone Deviation Control, R803, for ± 0.5 to ± 1.0 KHz tone deviation
- e. Apply 0.5 to 1.0 volts RMS at 1 KHz audio to the microphone input
- f. Adjust Deviation Control, R216, for ± 5 KHz composite deviation

10-3 SPECIFICATIONS

Frequency Range.....	EIA Standard Frequencies from 67.0 to 250.3 Hz
R.F. Sensitivity.....	0.15 μ v
Response Time.....	325 ms (max.)
Encode Deviation.....	Adjustable, 0 to ± 1 KHz

10-4 VOLTAGE CHART

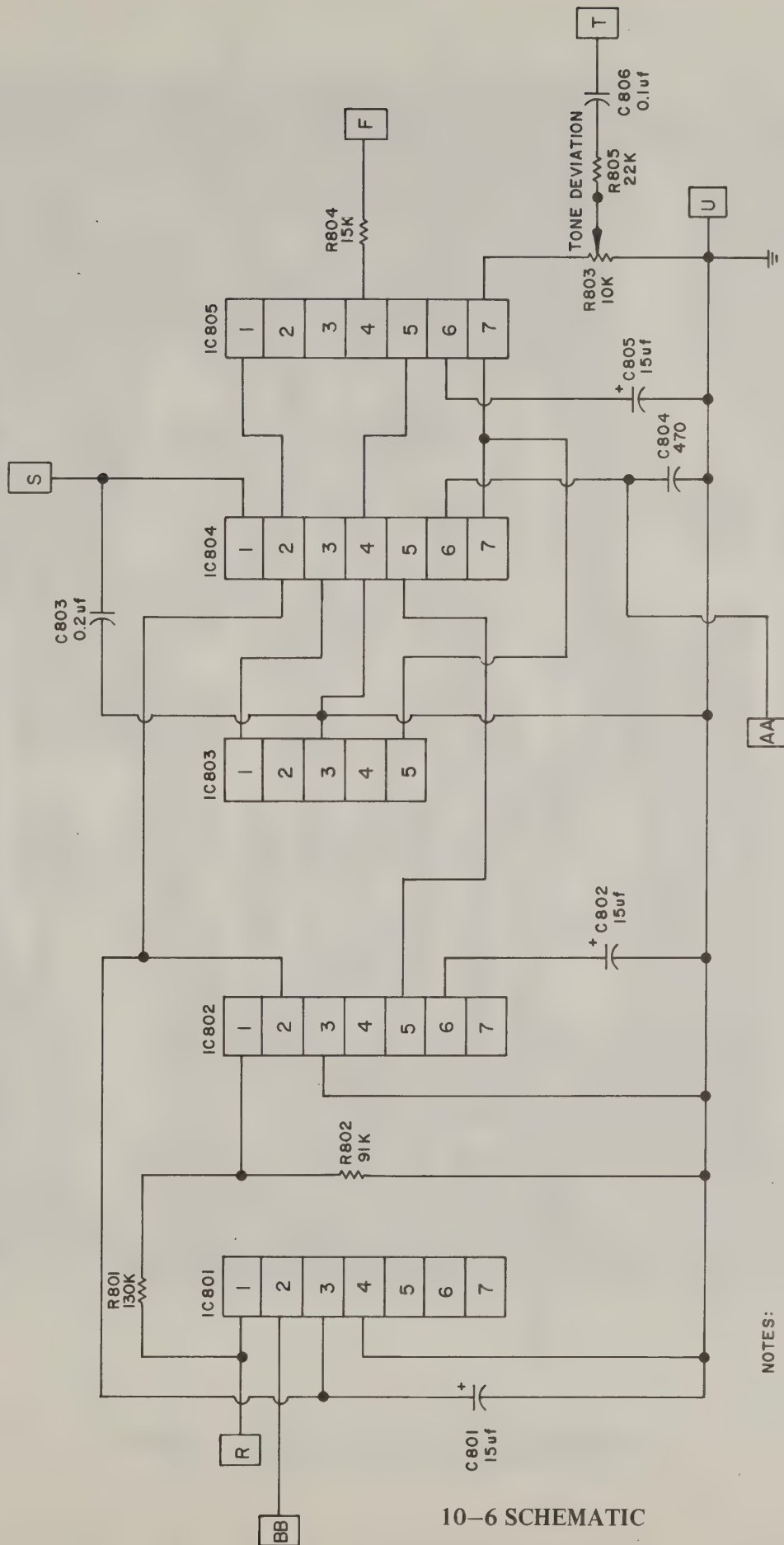
	1	2	3	4	5	6	7
IC801	3.8	AC	10	0	NC	NC	NC
IC802	1.6	10	0	NC	6	5.5	
(2)	1.4						
IC803	5.3	NC	0	NC	5.3		
(1) (2)	5.2				5.2		
IC804	13.8	10	5.3	0	6	.1	5.3
(1) (2)			5.2		0		5.2
IC805	10	NC	NC	0	0	3.2	5.3
(1)				7.2		5.6	5.2
(2)				0		3.2	5.2

NOTE: All voltages are nominal and were measured with a VTVM, 13.8 VDC supply. Microphone off-hook.

1) Denotes readings with microphone in grounded hang-up clip.

2) Denotes readings with conditions as in 1) and R.F. signal with code tone applied.

ENC / DEC TONE BOARD - 501-290

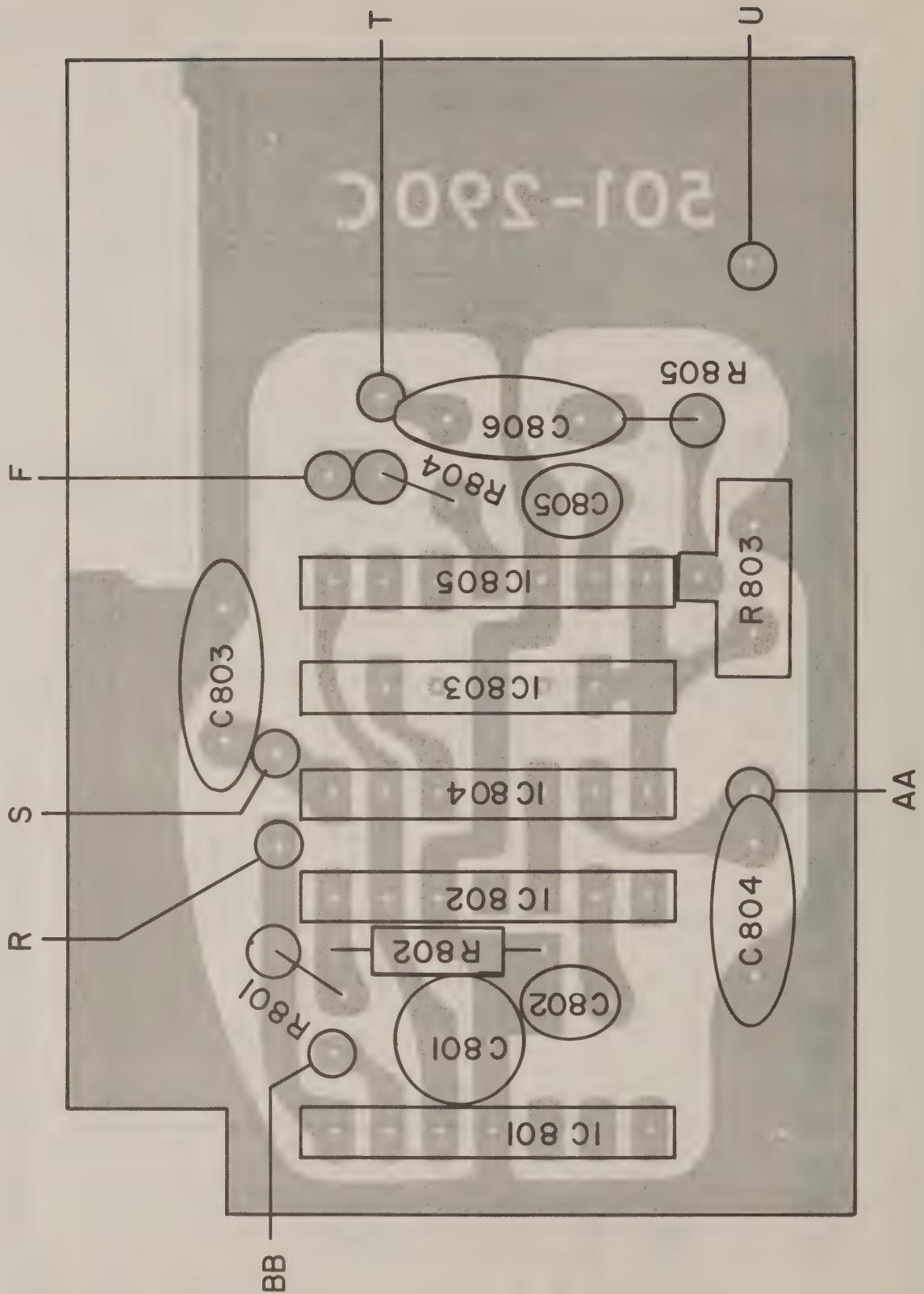


NOTES:

1. ALL CAPACITORS NOT SPECIFIED OTHERWISE ARE PICO FARAD
- ALL RESISTORS NOT SPECIFIED OTHERWISE ARE OHMS
- ALL RESISTORS NOT SPECIFIED OTHERWISE ARE 1/4 WATT
2. REFER TO DRAWING 700-214 FOR BASIC RADIO SCHEMATIC
3. LETTERED BOXES ARE CONNECTION POINTS TO BASIC RADIO SCHEMATIC

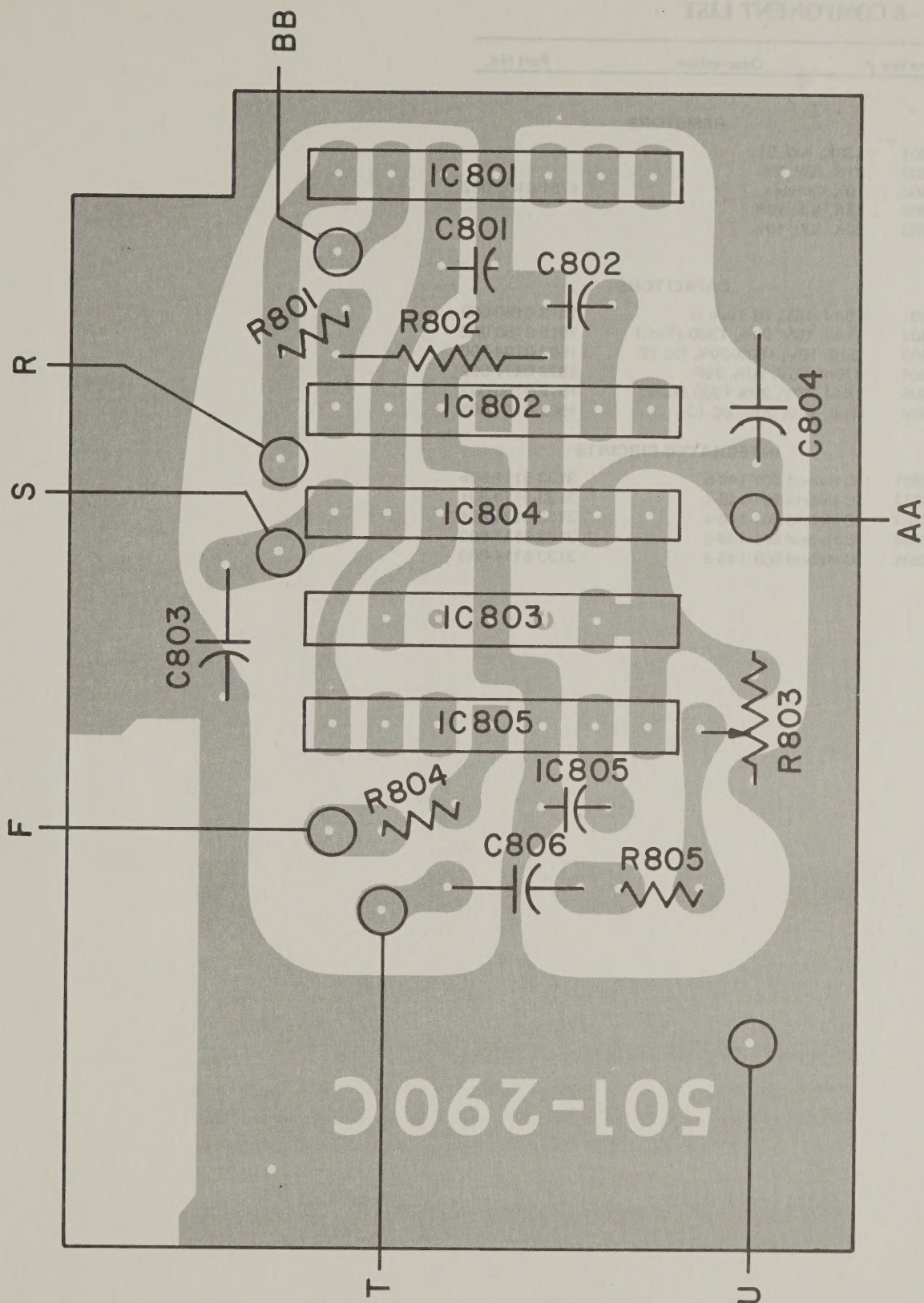
10-6 SCHEMATIC

TONE OPTION BOARD 501-290



10-6 TONE OPTION BOARD PARTS PLACEMENT

TONE OPTION BOARD 501-290



10-7 TONE OPTION BOARD BOTTOM VIEW

10-8 COMPONENT LIST

Item No.	Description	Part No.
RESISTORS		
R801	130K, ¼W, 5%	4751-0103-002
R802	91K, ¼W, 5%	
R803	10K Variable	
R804	15K, ¼W, 10%	
R805	22K, ¼W, 10%	
CAPACITORS		
C801	15mf, 16V, III Tupe U	1513-0150-002
C802	15mf, 10V, 20%, T360 (Tant)	1515-0150-002
C803	.2mf, 12V, +80%-20%, BC-12	1502-0204-006
C804	470pf, 50V, 20%, 25F	1523-0471-002
C805	15mf, 10V, 20% T360 (Tant)	1515-0150-002
C806	.1mf, 12V, 20%, BC-12	1502-0104-005
INTEGRATED CIRCUITS		
IC801	IC Hybrid 501-148-5	3133-5114-805
IC802	IC Hybrid 501-148-1	3133-5114-801
IC803	IC Hybrid 501-148-4	3133-5114-804
IC804	IC Hybrid 501-148-2	3133-5114-802
IC805	IC Hybrid 501-148-3	3133-5114-803

THE STATIONER'S LIST

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